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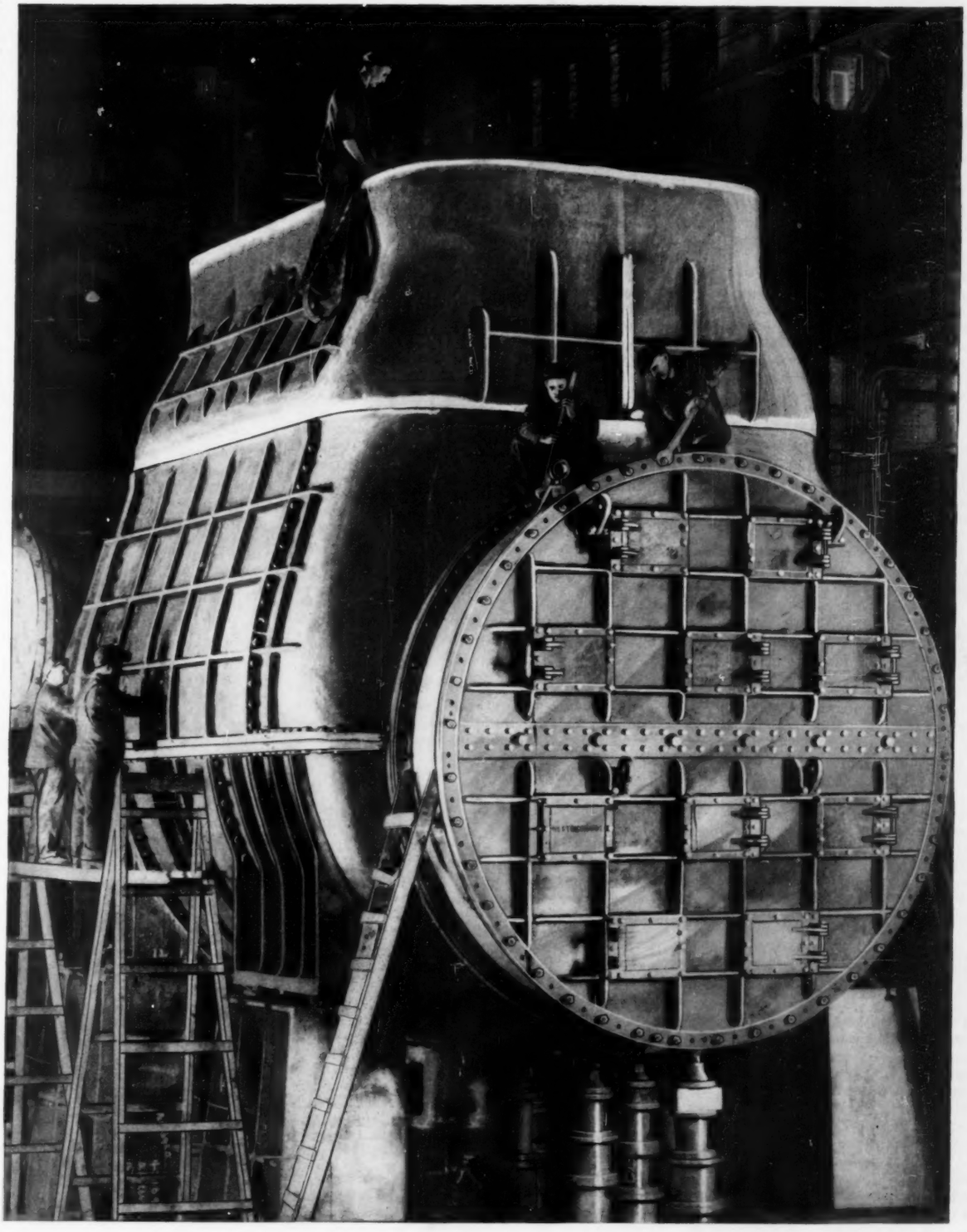
SCIENTIFIC AMERICAN

A Weekly Review of Progress in

INDUSTRY · SCIENCE · INVENTION · MECHANICS



ASSEMBLING A HUGE CONDENSER UNIT FOR A STEAM-ELECTRIC POWER PLANT

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Is Airship Travel Profitable?

IT has been proved that the airship, if properly built and carefully navigated, is a practical means of transportation. When Zeppelin had brought his work through its purely experimental stages, he built airships that proved to be reliable for passenger travel. Statistics show that, up to the outbreak of war, German airships carried over 35,000 passengers for a total distance of 100,000 miles without death or injury; and many improvements, including the mooring mast, have been introduced since then. Deplorable was the accident to "ZR-2," but it will not prevent airship travel. Deplorable, also, was the loss of the "Titanic"; but people still travel in steamships and will continue to do so in increasing numbers.

Airship travel is practicable; is it also profitable? In the absence of any exact statement from the operating companies, the question is open to conjecture, with the probabilities in favor of an affirmative answer. An analysis recently made by *The Engineer* is based upon a comparison of "R-36" with the Cunard liner, "Carmania," at the close of which our contemporary admits that the commercial prospects of the airship are "hard to determine."

"R-36" is a sister ship to "R-34," which, two years ago, made a successful flight from England to the United States and back. The "Carmania" is chosen in preference to a fast ship like the "Mauretania," because this type—on account of the high cost of operation and small freight-carrying capacity—we know to be uneconomical. The "Carmania" carries 1995 passengers and a crew of 513. Making a round voyage in four weeks with full passenger lists, she can carry 51,870 passengers per year. "R-36" carries 50 passengers and a crew of 28. At 65 miles an hour she would make the round voyage in seven days. At full capacity she would carry 5200 passengers per year. Hence ten similar airships could carry the same number of passengers as the "Carmania." The ten airships would include 15,700 horsepower and a crew of 280; the "Carmania" requires 21,000 horsepower and 513 men.

This surprising economy of 25 per cent in power and 45 per cent in crew, in favor of the airship, is modified in the opinion of *The Engineer*, by the probability that although, with care, the "Carmania" might run at full pressure, *continuously*, for a year, the ten airships could not be so run—ten additional airships might be required as a reserve. On the other hand upkeep is in favor of the airship, since only one out of the ten need be laid off at a time for repairs, whereas the whole service must be withdrawn in the case of the steamship.

On the question of engine up-keep the steamship shows to great advantage. The power plant of the ten airships, aggregating 400 cylinders, 800 valves, etc., would have to be overhauled at the end of every second round trip, and the separate engine overhauls would amount to some 1300 per year. Another expense peculiar to the airship would be the loss of hydrogen, which, at 5 per cent of the capacity per round trip, calls for 55 million cubic feet replacement for the ten airships per year.

Attention is drawn to the fact that there are features in the comparison, as given above, which "clearly suggest the need for the utmost caution, before a definite opinion is formed as to the commercial prospects of the airship." The analysis neither proves nor disproves the case.

On the other hand the economy of ground personnel, due to the use of mooring masts would place the airships at an advantage; though against that must be set the much greater freight-carrying capacity of the "Carmania." "R-36," when fully loaded with 50 passengers, can take but 2¼ tons of baggage.

Summing up, our contemporary sees "the need for the utmost caution, before a definite opinion is formed as to the commercial prospects of the airship," and this in spite of the fact that in the important matter of capital costs the advantage inclines to the airship.

This is an impartial study of a difficult problem; but we must not forget that airship navigation is yet in its infancy compared with that of the steamship, which celebrated its centenary nearly a quarter of a century ago.

The Divining Rod

WE know so well what comment will be offered on Mr. Cone's article of page 219 that we take the opportunity of making it ourselves, in this place. It is quite true that one of the most persistent of the medieval myths is that of the divining rod. It is equally true that this myth is continually cropping up in modern times, usually being invested with an ostensibly scientific character by being tied up with some phenomenon, as radioactivity, which is at the moment imperfectly understood.

On the other hand, nobody ever knows what the science of the future may bring forth. It is by no means impossible that emanations of one sort or another are given off from *every* element and *every* compound, not merely from the bodies so far officially recognized as radioactive. It is by no means improbable that emanations of this sort, granted they exist, are sufficiently different, in point of speed, intensity, etc., for different bodies, to make it possible to recognize the body from the emanations. It is altogether likely that such emanations, if they but exist, will penetrate matter quite as freely as X-rays and the electrons, etc., to which we have attached the names of alpha, beta and gamma rays. An open-minded attitude prevails on this subject in scientific circles, as attested by the fact that, in France, the Academy of Sciences and the Ministry of Agriculture have been investigating the divining rod for some years, while in Germany and Austria its possible military applications were tested under official auspices during the war.

Heretofore the reports that have cropped up from time to time that such an instrument had at last been brought to the level of practical perfection have turned out to be wholly mythical, and usually deliberate frauds in the bargain. On general principles the probability is of course strong that any particular further case of similar claims is in a similar class. It would seem plausible to suppose, moreover, that if the versatile divining rod which Mr. Cone describes had really been invented in Germany and put into successful use in that country, we should not have to depend upon the reports of a returned traveler for our information about it. The tale implies discoveries of such import in physics that we should surely have expected it to have a conspicuous place in such journals as the *Physikalische Zeitschrift* and the *Annalen der Physik*.

Mr. Cone, however, is associate editor of a prominent technical and trade paper. He assures us that he has investigated the story; and he and his associates have sufficient confidence in it to give it a prominent place in their own columns. Mr. Holz is a dealer in scientific instruments of precision of the highest standing. It is impossible to attribute fraud to him, and almost impossible to suppose that he is deceived in such complete measure as such a hypothesis would demand. The impulse of the SCIENTIFIC AMERICAN toward this story was at first rejection, and later was toward suspension of judgment until we had been able to verify the details for ourselves. Unfortunately, however, we have no oil well, no caché of hidden gold, in our back yard—no really effective means of trying the instrument on a deposit of mineral, whose location shall be unknown to the gentlemen who are promoting the fortunes of the divining rod. So we have decided to cut the Gordian knot by letting Mr. Cone tell Mr. Holz's story in his own name and in Mr. Holz's name. We are inclined to credit the story; but we are not in a position to guarantee it and do not see how we can attain such a position. We wish to make it plain, however, that we carry the tale with full realization of its possibilities—both in the direction of fraud and in that of real achievement.

Scientific American Landmarks

AT a time like this, when the SCIENTIFIC AMERICAN is about to make the radical change of appearing as a monthly magazine, we naturally feel reminiscent and turn to the time, over three-quarters of a century ago, when this journal made its initial and very modest appearance. As started by its founder, Rufus Porter, the whole paper consisted of only four pages, and as we recently noted in these columns, the net printed edition was easily carried to the post office by one of its Editors.

After some twelve months of rather precarious existence it was purchased by two young men, former schoolmates, Orson D. Munn and Alfred Ely Beach. Young Beach had been initiated into journalism in the editorial rooms of the New York *Sun*, and under the guidance of his father, Moses Y. Beach, the publisher and owner of that paper.

The SCIENTIFIC AMERICAN started its career under auspicious circumstances. The railroad and the steamship were in the first flush of their commercial success. The spirit of invention was abroad, and America was upon the threshold of that career of industrial development which was to advance the young Republic to its present commanding position. In the first half of the nineteenth century opportunities for acquiring technical knowledge were few; for our present magnificent system of schools and colleges devoted to technology is of comparatively recent growth. Consequently, it was natural that the SCIENTIFIC AMERICAN, which was practically a pioneer in its field, should make an instant appeal, and that its offices should become a place of rendezvous for the pioneers in invention and technical development. Morse, Edison, Howe of the sewing machine, and many another whose name has since become a household term, were frequent callers. It was in our offices that Edison's experimental phonograph was first exhibited, when it startled the Editors by wishing them "good morning." From the very first, the inventive and mechanical genius of America received a sympathetic welcome and much helpful advice in the editorial room of the young Editors and publishers.

And what an era of invention, particularly of American inventions that were destined to become world-wide in use and reputation, was the first ten years of the life of the SCIENTIFIC AMERICAN. As we run through the record of that decade we come across Hoe with his development of the revolving press; of Merriweather, the California miner, with his hydraulic system of mining; Corliss with his famous valve gear patented in 1849; Worthington with his independent single direct-action boiler steam pump; The Jones and Sampson Machine Company with their turret lathes; Elias Howe with his epoch-making sewing machine; followed by Wilson and Gibbs with their rotating hook, to say nothing of Singer from whose invention has sprung enormous business institutions still known by his name. It was in this same decade that a Lynn shoemaker adapted the sewing machine to sew the uppers of shoes. In the same period Otis installed his first elevator, and Charles Thurber patented a slow typewriter which embodied the longitudinal motion, and Francis, four years later, improved it by introducing the piano hammer action. Although McCormick had built his first harvester long before, the first practical harvester made its bow to the public at the same time as the SCIENTIFIC AMERICAN. All of these inventions and a host of others of less significance were recorded in the paper side by side with the latest discoveries in science and the more notable feats in mechanical and civil engineering, scientific search and exploration, as well in the field as in the laboratory.

The desire of the Editors to give a fuller presentation of the exhibits of the Centennial Exposition than was possible in a single paper led to the publication, in 1776, of the SUPPLEMENT, which became so popular that its publication was continued, under that name, for forty-three years. In 1920 it was decided to change that publication from a weekly to a monthly. The instant approval of this policy by the subscribers is one of the motives that has prompted the Editors and publishers to make a similar departure with the parent paper, and include the two separate publications in a single monthly, that will include the characteristic features of both.

Engineering

John Fritz Medal Award. — Eugene Schneider, French engineer and scientist, has received at Paris from the hands of distinguished American engineers the 1922 John Fritz medal. Closer engineering cooperation between the two countries is thus promoted.

A New Canadian Railroad. — It is announced that construction work will be commenced at an early date of a logging railroad northward from Squamish, British Columbia, to the vicinity of Lake Alice. According to estimates upward of 2,000,000,000 feet of logs will become available for transportation by this means, and it is anticipated that something like the activity of former years will again be in evidence. The new undertaking will have incorporated with it the booming grounds formerly operated by the Howe Sound & Northern Railway, making possible the handling of unlimited shipments.

The Baku-Batum Pipe Line.—At the present time it is an established fact that pumping operations have commenced in the Baku-Batum oil pipe-line on a small scale. It is reported that, at the present moment, there is in Batum only about 4,000,000 poods (about 500,000 barrels) of oil. This includes mazout, kerosene, crude oil and gasoline, and covers not only oil which has come through the pipe line but also that which has been transported by rail. The pipe line is being used to pump mazout. There is a small trade being done by a few Armenians and Jews who have been able to obtain oil in lots of 200, 300 and 500 tons.

Improvements in Palestine.—Assistant Trade Commissioner Julian E. Gillespie, who has just completed a visit to Egypt, Syria, Palestine, and Smyrna, states that the Government of Palestine has projected an enlargement of the ports of Jaffa and Haifa, the erection of a large waterpower plant sufficient to meet the needs of all Palestine, the irrigation of the Jordan Valley, and the construction of a railroad from the Sea of Galilee directly east to connect with the Bagdad Railway. However, it is probable that only the port improvements at Jaffa will see accomplishments in the near future. This project is being urged by the orange growers and shippers of Jaffa.

A Mexican Pipe Line is being planned by Clay T. Yerby of Los Angeles, who has been granted a concession by the Mexican Government. The pipe line is to run from Puerto Mexico, on the Gulf coast, to Salina Cruz, on the shore of the Pacific. It is said that the pipe line will follow the Tehuantepec Railroad. Work on the first pipe line, a ten-inch line, will begin at once and will be completed within 26 months. The estimated cost of the work will be 10,000,000 gold, and it is pointed out that by means of the pipe line the time of transporting oil from the east to the west coast of Mexico will be cut down by eleven days and the distance covered will be 2300 miles less than through the Panama Canal.

Electrification Projects in Czecho-Slovakia.—One of the newspapers of Prague reports that a plan has just been submitted to the Ministry of Public Works for the construction of a dam some 230 feet high at Stechovice, 22 miles to the south of Prague. The proposed dam would be the means of obtaining 250,000 million kilowatt hours of electricity a year and of saving the Republic 60,000 carloads of coal. The first requirement for the proper development of this new Republic on an economic basis is said to be the increased national production, especially agricultural production. To this end it is necessary to devise a plan for the best utilization of the hydraulic resources of the country and to study the means of putting this plan into operation. Many of the largest industrial organizations in Bohemia have already pronounced themselves in favor of the project, and its realization will be a big step in advance.

Amsterdam's New Grain Elevator.—The first complete and separate grain elevator, not a part of some other structure, in Amsterdam, has just begun operations. It is the result of dissatisfaction with the primitive methods which have always been used in Amsterdam for loading and unloading grain on and from steamships and railway cars. The elevator is located at one of the most important freight docks in the harbor, from which various railway tracks radiate. It has a present capacity (which can be quickly doubled) of 132,000 pounds per hour, and is operated by electricity through a motor of 100 horsepower. Grain is put into sacks or loaded direct from cars to steamships, and vice versa, saving the cost of transfer lighters. Four weighing machines keep accurate account of quantities. The elevator building is constructed entirely of concrete, which has become a very much used material in this district for the construction of buildings and bridges and certain kinds of boats.

Science

"Oldest Dwelling" Discovered.—A stone-age dwelling, still containing domestic utensils, has been found; it is said to be the oldest so far discovered in Eastern Prussia.

Once in a Lifetime. — With the Lapland thermometers at 86 degrees, bathing parties are said to be popular among the sweltering Eskimos. The reindeer and other animals are suffering intensely.

Child Suicides.—In the first half of 1920, 225 of our children killed themselves; in the first half of 1921 almost double that number committed suicide. Fear of school examinations was the prevailing motive.

Rats and Plague.—Observations on the eradication of plague by rat destruction strongly suggest this to be the main factor in bringing infection to a natural end. Barium carbonate was found to be the best poison.

A Bolt from the Blue.—Without warning, rain or wind, lightning killed one boy and paralyzed two others near Nahant Beach, Mass., as they were walking home in their bathing suits.

A Busy Twenty Minutes. — In the next ten years astronomers have but 20 minutes in which to test Einstein's theory. During the fleeting moments of the solar eclipses they will work strenuously in an attempt to discover any deflection in the rays of light that pass the sun.

Edibles from the Amazon.—The Mulford Biological expedition is already accomplishing good work in the Amazon basin, and has made one important shipment of botanical specimens, among them three edible fruits, the pepino, the tumbo and the acchocta, and a turnip-like root, rhacache, of delicious flavor.

Metric Bill Before Congress. — The Britten bill would make it unlawful, after ten years, to sell, charge, or collect on other than a metric basis. Manufacturers opposed this propaganda so strongly that they secured their exemption under the present bill, but its passage would doubtless be the opening wedge for a general adoption of metric weights and measures.

Paper from the Bamboo.—Before long, according to British scientists, the manufacture of paper from bamboo is likely to be undertaken on a large scale in several countries. Well-equipped factories are already running in Indo-China and others are being planned to handle the supply from Trinidad, Burma and Madras. Paper made wholly of bamboo pulp is said to be well suited for the higher grades of printing paper.

New Test for Gold.—The Bureau of Standards has perfected a spectroscopic analysis of gold. Tiny electric sparks jumping from one stick of gold to another are photographed through a diffraction grating; the most minute quantities of the baser metals are revealed, and the highest grade of the San Francisco mint, known as "1000 fine gold," is shown to be but 99.997 pure. The findings of the device are said to be accurate to one part in a million.

Thumb-Sucking As a Beauty Spoiler.—An American writer in the *British Journal of Photography* reminds us that Sarony, the New York photographer, attributes the cause of one side of the face usually being less well formed than the other to the child's habit of sucking the thumb, which permanently distorts the cartilages of the nose. Sarony, who was well known to the present abstractor, always maintained that one side of the face was better than the other and usually proved his case.

French Colonial Exhibition. — After 16 years of planning by the cream of French talent, a magnificent park of 90 acres' extent is nearing completion at Marseilles. Here will be held the Colonial Exhibition and here, grouped around a spacious esplanade, may be seen striking reproductions of Algerian palaces and Asiatic temples, housing the products of the colonies; modern halls will hold the machinery and finished goods exported to the foreign possessions. Four congresses will study colonial questions of health, production, tools and organization, while other meetings will discuss science, art and literature.

Fox Talbot Memorial.—W. H. Fox Talbot, inventor of the calotype (talbotype) process, and the first to produce positives from negatives, died in 1877. His large historical collection has recently been presented to the museum of the Royal Photographic Society, and includes a camera lucida, a sketching camera, and scientific instruments used in his experimental work. These, with the notable Hurter and Driffield collection and other apparatus of national interest, are features of the Society's annual exhibition, opened to the public on September 19th. The Society is calling for popular contributions to a fund to be used in setting up a permanent memorial at Lacock, the birthplace of the scientist.

Aeronautics

A French Air Port.—Official figures for the movement at the air port of Le Bourget near Paris, during the month of July, show that 511 airplanes, carrying 2285 passengers, 13 tons, 7 cwt. of goods, and close upon four tons of mails, entered and left the "port." Last year's figures for the same month were 390 airplanes, 965 passengers, and 9 tons, 3 cwt. of goods.

Britain's Secret Helicopter. — Press announcements recently have directed our attention to the new type of machine which is being constructed at the Royal Aircraft Works at Farnsborough, England. It is reported that only the most trusted workers are being employed in this work, and that the tests are to be conducted at an isolated spot and most likely at dusk, so as to preclude spies. Much is expected of the new machine, and it does seem as if the British have hit upon a new idea in flying machines.

Civil Air Services in French Guiana.—At present six hydro-airplanes are running a regular service between Saint-Laurent du Maroni and Cayenne and Paramaribo (Dutch Guiana), and air transport has become popular both for passengers and freight. Transportation of goods is very remunerative, as people prefer to send gold, balata, essence of rose, etc., by aircraft, which cover the distance from Saint-Laurent to Cayenne in six hours, whereas by canoe the time taken is twenty days.

Aviation at Foochow. — Several successful test flights have been made with a hydro-airplane constructed by Chinese engineers at the Chinese Government Dock and Engineering Works at Foochow. All the material used in this plane (which was specially designed by a Chinese engineer), with the exception of the engine, which is of American design and manufacture, was produced in China. The Foochow works have several more of this type of airplane under construction for use by the Chinese navy.

An Airplane Flight to the North Pole is to be attempted by Edwin Naulty, an American aviator, according to recent press announcement. This aviator proposes to start from Point Barrow, in Alaska, and hopes to reach the northwestern corner of Spitzbergen. The airplane will carry four men and fuel for a fifty-hour flight. If conditions permit, several landings will be made on the polar ice, but if this proves impossible the 1800-mile flight will be made without descent. From Spitzbergen Mr. Naulty proposed to continue his flight via Norway to London. The flight may throw some light on the doubtful existence of land in the eastern part of the Beaufort Sea.

Daily Service to Capital.—A New York organization has just announced the purchase of six Fokker limousine monoplanes to be put in immediate operation between New York City and Washington, D. C. Each plane will carry six passengers and 1000 pounds of baggage on a trip. It was our recent good fortune to witness the flight of a Fokker monoplane over the Hudson River from lower New York City. Frankly, this machine is far more graceful than the usual biplane. It flies with a remarkable steadiness and at a surprising speed. Then, too, judging from its economical operation there is every reason to believe that this type will be used more and more for passenger-carrying purposes.

Government Control of Aviation.—From Washington comes word that investigation into the probable scope of Government regulation of commercial aviation, under proposed legislation, has been begun by the Department of Commerce. According to Secretary Hoover, Government supervision of air traffic along the lines of rail and water regulation was recommended by a committee of the War, Navy and other Departments, in order to increase the safety and more efficient development of the new method of transportation. It is not unlikely that a bureau of aviation will be created, charged with the enforcement of rules of air travel similarly to the activities of the Bureau of Navigation in connection with water carriers.

Multi-Engined Geared Power Plant.—Realizing that the future of the passenger-carrying airplane depends very largely upon the development of reliable and powerful engines, Edson F. Gallaudet, an aeronautical designer and builder of East Greenwich, has constructed a power unit for large airplanes consisting of three Liberty engines geared to a propeller with a clutch. This power unit is claimed to assure non-stop flights from New York to Liverpool in 20 hours or less. Two Liberty engines are side by side, with one in back, it being the plan of operation to run two engines with one always in reserve. Each Liberty engine of the group develops 400 horsepower. The Gallaudet power unit, along with two others of the same design, is to be delivered to the U. S. Navy.

Saving Food Fish by the Hundred Million

How Victims of the Mississippi Overflow Are Returned to the Main Channel

By George H. Dacy

Launch and rowboat are used to carry the rescued fish back to the open channel, where they are released

JUST as regularly as the calendar completes its annual cycle, the Mississippi River goes on its spring jamborees and rampages, overflowing its banks, inundating bottom lands which verge its boundaries for several miles inland and washing untold myriads of adult and baby food fish far away from their natural habitat — the open channel—marooning these finny river residents in temporary ponds, pools and puddles where ultimately they die unless rescued by man and returned to the river. Some years back, the Government fish authorities sensing the vast, economic importance of fostering foundation schools of river food fish carefully scrutinized the Mississippi uprising devastations to the extent that they finally instituted a system of organized fish rescue work which, from that time to this, has been effective in saving approximately $75,000,000 worth of breeding fish for the replenishment of our Father of Waters and its tributaries and for the stocking of inland lakes and streams.

The Mississippi River floods which are serious limiting factors in spelling the success or failure of the cotton crops abutting its borders in Mississippi, Louisiana and Texas are even more grave menaces to the multiple fish tribes which populate its waters. The most destructive Mississippi freshet—from the fish protection standpoint—is known as the "June rise," and occurs just about the time the adult fish are ready to spawn. It develops considerably later than the spring freshets caused by melting snow but is equal to them in volume and accomplishes more serious damage. When the river rises and overflows its banks, it carries vast volumes of water to inshore depressions, nooks and crannies which for the time being—after the recession of the main part of the flood water—are converted into miniature ponds, pools and lakes, some of which are many acres in size. Obeying their natural impulses to seek places of quiet and seclusion, the adult fish desert the main channel at flood time and seek the backwater regions where they deposit their eggs.

The eggs are laid under propitious circumstances and environments which result in the hatching of large crops of young that from the outset develop rapidly and often attain lengths of several inches before the freshet begins to subside. The adult fish immediately make for the open channel when they appreciate that the flood water is receding and attain places of permanent safety before barriers in the form of stretches of land suddenly released from flood captivity, shut off their retreat. The young fish do not react promptly to the ebbing freshet and soon are landlocked in the temporary puddles and pools. Some of these overflow pools dry up in a few days or weeks, others endure for several months, constantly diminishing in size due to seepage and evaporation, while others remain until late fall when they freeze up. The larger pools provide rich feeding grounds for the baby fish, where they grow as large as 8 or 10 inches in exceptional cases before ice forms. However, in any event, the landlocked fish ultimately die of starvation—unless rescued by human agency—smothering when the ice forms in small pools or succumbing to cannibalism or being destroyed by wading birds, snakes, turtles and other fish-eating creatures.

Uncle Sam's rescue parties usually consist of 5 to 8 fish experts to a crew, usually recruited for the campaign from among the employees of the Bureau of Fisheries. They ply the innundated areas in gasoline launches and house boats and utilize flat bottom row boats for penetration to the points where the water is extremely shallow. Armed with fine-mesh seines, small dip nets, galvanized iron wash tubs of one and one-half bushels' capacity and tin dippers, they invade the temporary ponds and lakes and capture the run-away fish. The rescue season usually begins about the first week in July and continues until after Thanksgiving, when the ice forms over many of the waters so densely that further salvage work of this description is impossible. The stretch of the Mississippi covered by these fish conservation activities extends from Minnesota to Mississippi, although during the fiscal year ending July 1, 1921, the work was concentrated largely in Minnesota, Wisconsin, Illinois and Iowa as in this region the damage is greatest and salvage most important. A dozen crews operating out from special river headquarters in the territory mentioned saved 120,656,500 fish worth approximately $6,000,000 from landlocked water fates last year. This salvage amount is an average representation of the fish rescue work. Several years ago a record rescue of 157,000,000 food fish was consummated. Fish experts estimate that at least 25 per cent of the fish rescued ultimately attain a marketable size at about the age of one-and-one-half years and are consumed as human food.

Practically all the varieties of food fish native in the Mississippi are saved by the rescue crews, such breeds and families as the crappies, carp, catfish, buffalo fish, sunfish, pikes, perches and black bass being most common. The fish are caught in seines, and when lifted they are rapidly transferred to the galvanized tubs which contain supplies of river water. The fish catch is computed by the displacement of water in the tubs which is carefully measured, the fish being sorted as to variety. As soon as possible, the rescued fish are conveyed in rowboats or launches to the open waters where they are again liberated in the Mississippi. Approximately 1 per cent of the rescued fish is sent to special retaining stations where they are trained and hardened so that they can stand long railroad shipment. Finally, they are shipped in milk cans or carloads to various lakes and inland streams where they are used for stocking such waters. The cost of this salvage work is insignificant, the usual rescue expenses amounting to not over 25 cents per thousand fish saved while during recent years annual costs as low as 13 cents a thousand fish have been recorded.

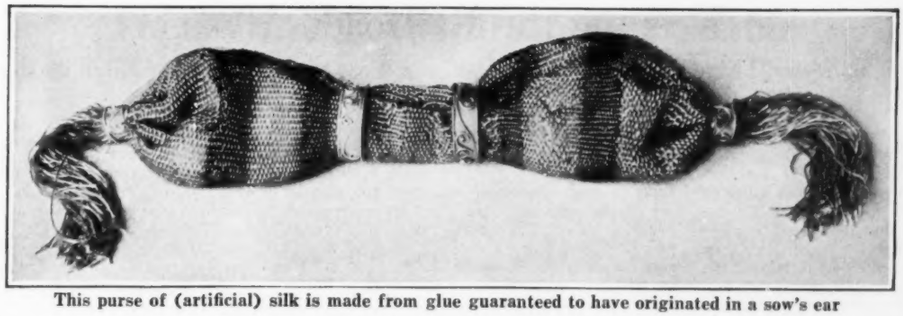
It is necessary to agitate the water in the tubs where the fish are kept during their trip from the inland pool to the river as, otherwise, many of the tiny swimmers would be smothered. This is accomplished by elevating dippers of the water several feet above the tubs and then allowing their contents to pour into the receptacles. This combined with the squirmings about of the masses of juvenile fish keep the water well aerated. Extreme care has to be exercised in handling the fish, especially those taken from the shallow pools from which much of the overflow water has abated or evaporated, as the stamina and vitality of such specimens generally are low because they have suffered from lack of food while the sun has heated the water in their unnatural natatoriums to abnormal temperatures which have been inimical to the

(Con'td on page 227)

The small fish are sorted as to size, variety and sex as they are taken from the nets

Silk Purses and Sow's Ears

YOUR grandmother's favorite exemplification of the utterly and absurdly impossible was to the effect that "You can't make a silk purse out of a sow's ear. From your grandmother's viewpoint there was simply nothing to debate about this—it was the acme of self-evident things. But a prominent firm of chemical engineers, in connection with the recent chemical show in New York, have undertaken to show that you can't always tell what is impossible.



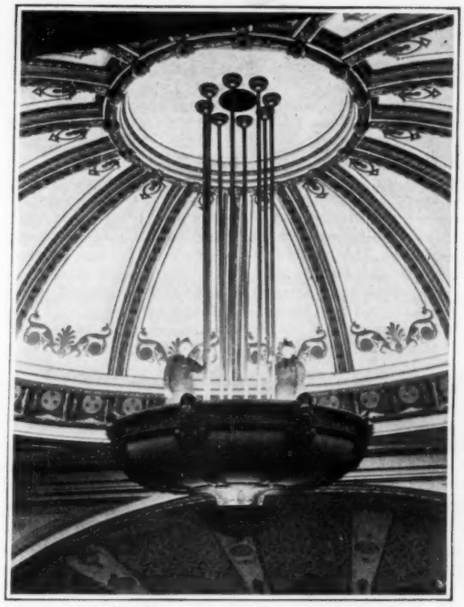
This purse of (artificial) silk is made from glue guaranteed to have originated in a sow's ear

The silk-worm produces silk by forcing a gummy mass through tiny orifices in its head, the jets hardening into silk fiber as they reach the air. Almost anything in the nature of a gummy mass ought to be susceptible, artificially, of the same treatment. So they got from one of the big Chicago packers a mass of sticky stuff that was guaranteed to be pure extract of sow's ear, and they treated it just as one would treat cellulose in the silk factory—that is to say, in the artificial silk factory. The result was a perfectly good variety of artificial silk, and when there was enough of it it was woven into a silk purse for the show.

So it is demonstrated that in the light of science the assertions of a thousand generations may need reconsideration, and nothing should be considered offhand as impossible.

The Biggest Lighting Fixture

WHAT is declared to be the largest indirect lighting fixture ever built has just been installed in a new theater in Milwaukee, Wis. It has a diameter of 15 feet and weighs approximately 5500 pounds. The large bowl is so immense that it was necessary to provide a second bowl to illuminate it. The top bowl contains 118 lamps and can be reached by means of a ladder extending down the 25 feet from the hole in the center of the dome. To support this fixture eight 2-inch pipes 25 feet in length are required. From the smaller bowl a cable can be lowered; it has at the end a leather outfit. This enables a man to be hoisted to the small bowl so that he can clean the lower surface of the large bowl.

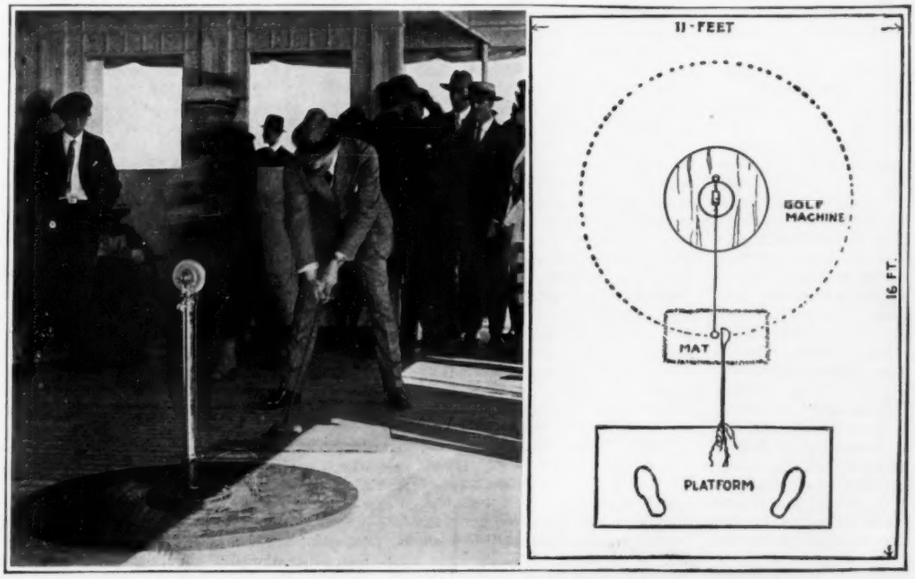


A lighting fixture 15 feet across

A Golf Machine

WHO has not heard the lament of the duffer, who can "swing in perfect form" on a grass-blade or a cigarette box, but who the moment a little white pill is substituted for this unresponsive target, develops a slice or a pull that is horrible to behold? Here we have the cure for this state of affairs—a little instrument that will do away with grass-blades and cigarette boxes as targets, and supply in their stead an object to swing at which will flatly contradict the duffer's cheerful belief that the blind swing was flawless. For the truth must be that if a ball were to be miraculously dropped in the path of one of these "perfect" swings, it would be found to show the same old slice or pull or topping.

The machine illustrated is nothing more or less than a captive ball hitched to a dynamometer. But instead of the ball being on an absurdly short tether, so that in the very nature of the case nothing can be recorded save the mere force of the initial impulse given it, this ball is wired to a near-frictionless collar that rides on a vertical shaft. The ball, struck by the club head, takes flight to the limit of its tether, and then instead of bringing up dead it proceeds to spin round and round, carrying the collar with it. In a general way it stays in the air as long as it would if it were free, and it has the same time in which to develop the effects of a slice or a pull. The mounting on the collar is so arranged, in its turn, that the moment the ball begins to pull out of the true line the resultant drag upon one edge of the collar is communicated to the dial, which ultimately registers the distance which the sphere would have made down the course. Each revolution of the captive ball amounts to ten yards of actual flight and is so recorded. For its setting up the outfit requires a space sixteen feet by eleven; it has to date found especial popularity on board steamship. A photograph of the device appears below, as well as a diagram of the layout in actual use and space required.



The latest and most effective machine for indoor golf, and how it is set up

Device Shows Students Dissection Work

IN one of the large lecture rooms of a prominent French university in Paris there has been installed an improved apparatus that projects dissection work vividly on a screen. The frog, rat, guinea pig or whatever animal is made the subject of the lecture is fastened on the table where the demonstrator can handle it readily. Suspended above the table is an object glass which is surmounted by a large reflecting prism that throws on the screen a clear picture of every movement in the operation. This presents all the details to the students and greatly enhances the value of the lecture, permitting them to see just what is being done or illustrated. The lighting system is the unique feature of the apparatus. For this purpose three great anti-aircraft searchlights are used. They are each of 5,000 candlepower and cast a brilliant light on the subject of the experiment or demonstration. It has been found through tests that these lights radiate far less heat and give a more satisfactory light than the electric arcs that are commonly used in this connection.

The Costliest Remedy in the World, Otherwise Known As Radium

THIS seems to be the era of Unknown Energy. Psychologists have found forces, hitherto unsuspected in man, and physicists are intently alert on radio-activity and its sources.

Radium, at first regarded as a mere curiosity to illustrate a lecture on physics, could be bought for $2 a milligram, as there was no demand for it; now the same quantity would fetch $30 to $40, as America no longer gets any from Austria, and that obtained from carnotite is extracted at great expense and the yield is small. The same difficulty of expense exists when it is used in the form of a gas inhalation or bath.

The question of these emanations is one of serious study in Germany, England and America. But, to carry out the whole thing technically, national institutes should have a well-equipped physical laboratory, an industrial one to work on the raw products, a biological section and also a therapeutic one. Waters and natural gases must also be studied, though the radio-activity may often prove very weak. Careful records should be printed in and distributed from all national institutes, giving the natural and local sources of radio-activity in minerals, waters and gases, with a view to the increase of knowledge concerning its procurability and therapeutic uses.

Its healing power has given it such a high value, and Madame Curie, at the Spanish Health Congress in Madrid this year, spoke hopefully of the present modes of treatment.

In certain cases weak injections of insoluble radium salts can be given, and for this, both in France and Germany, thorium X, a side product of radium, is used. It does not accumulate in the system and, in high dosage, produces considerable physiological effects.

As the emanation of radium is soluble in water, radioactive water can be used as a drink or as a bath. The water quickly loses its power when exposed to open air, so it is a little difficult to determine the quantity used.

All through the war Madame Curie went on working in her laboratory and for the soldiers. In 1911 she was accorded the Nobel Prize, and this year has received the highest honors from her own University of Warsaw. We all know of Madame Curie's recent visit to the United States, where she received the gift of one gram of radium and was showered with the highest honors.

Keeping the Railroads Afloat

The Water That Our Steam Lines Use in a Year and What They Do With It

By Charles Frederick Carter

IF the deductive method of reasoning which made Sherlock Holmes famous were applied to their annual consumption of water as the sole clue in order to form an idea of what railroads were like, the conclusion would seem to be justified that they must be navigable streams. The quantity of water required to keep the railroads of the United States afloat is beyond the conception of the average man.

According to C. R. Knowles, Superintendent of Water Service of the Illinois Central Railroad, recognized as the foremost authority on the subject, the estimated annual consumption of water by the railroads is 900,000,000,000 gallons. As a considerable proportion of the water used by railroads, amounting to 23 per cent in some instances, is purchased from municipal or private water corporations, and hence is metered, and as a number of the larger companies have water service departments which keep careful records, this estimate is more than a mere guess.

Perhaps it may help in attempting to form an idea of the immensity of this volume of water if it be reduced to cubic feet and the quotient divided by 1,030,000 the flow in cubic feet per second of the Amazon. The result shows that the railroads consume a quantity of water equivalent to the total flow of the greatest river in the world for a period of 32 hours and 48 minutes. Or, to apply a standard of comparison nearer home, the volume of water used by the railroads is equivalent to the total flow of the Mississippi River at its mouth for 58 hours, or 2 days, 10 hours, 47 minutes.

Twenty million cubic feet of water tumbles over the crest of Niagara Falls each minute. If the annual water consumption of the railroads were diverted into the Niagara River it would run the cataract for 101 hours, the equivalent of 4 days, 5 hours, 8 minutes.

Collected into one body the railroad water supply would make a lake ten miles square and 44 feet deep. Bottled and sold at current prices for so-called "Spring" water affected in large cities, the proceeds of this railroad deluge would bring in $90,000,000,000, or enough to pay off the entire interest-bearing National debt with the proceeds of less than seven weeks' average sales.

Locomotives consume for steaming purposes, or waste, 74 per cent of the total quantity or 2,807,999,985 tons of water. The total quantity of freight hauled by the railroads in 1916 was 2,316,088,894 tons; that is, the quantity of water passing through locomotive tanks and boilers was 491,911,091 tons more than the entire amount of freight moved in 1916.

Of the remainder of water required for railroad purposes 12 per cent is required to wash boilers and fill them at terminals, 5.5 per cent is consumed by stationary power plants at shops and terminals and 8.5 per cent is required for sanitary and "domestic" purposes at stations, offices and terminals and on board trains. At 7 cents per thousand gallons the cost of the railroads' annual water supply amounts to $63,000,000.

The matter of water supply is by no means the least of the perplexing problems confronting the railroads. For twenty years the increase in consumption has averaged 1.5 per cent a year. At that rate the consumption in 1930 will be 1,035,000,000,000 gallons. Already the limit of available supply at reasonable cost at some points has been reached.

Many of the Western roads have extreme difficulty in procuring sufficient water to keep the traffic moving. Between Bitter Creek and Green River, Wyoming, on the Union Pacific, local water supplies are so bad that they cannot be used for any purpose. Every drop used has to be hauled in tank cars from Green River. Rock Springs, 15 miles east of Green River, supplies the entire Union Pacific system with coal. The water there is so bad that the company is obliged to pump a supply through an 8-inch main for the fifteen miles, including a lift of 179 feet. At Rawlins, east of the Continental Divide, the company pumps its water supply for 15 miles, the lift in this instance being 236 feet.

Near the western shore of Great Salt Lake a Southern Pacific water tank is supplied by a pipe line 52 miles long. Altogether there are 150 miles of pipe line between Ogden and the Sierras to supply water for Southern Pacific locomotives.

Locomotives are supplied at approximately 13,000 water stations in the United States. Until very recently the standard type of water station, a familiar sight to every passenger who took the trouble to look out of the windows, resembled an exaggerated butter firkin on stilts. Usually they were 16 feet high and 24 feet in diameter, their bottoms being 16 feet above the rail. Such a tank held 50,000 gallons. As locomotive tanks increased in capacity to 10,000 to 12,000 gallons and traffic grew in volume such a station became altogether inadequate.

Modern practice is exemplified on the Rock Island, which has a number of steel standpipes of a capacity of 165,000 gallons, from which 12-inch supply lines lead to 10-inch water columns, and on the Santa Fe which also has steel standpipes 24 to 60 feet high with capacities of 96,000 to 202,000 gallons. The Chicago and Alton has some tanks 18 feet high, 30 feet in diameter, 20 feet above the rail with a capacity of 90,000 gallons from which 14-inch mains lead to 12-inch water columns through which 4000 gallons a minute can be delivered. The Pittsburgh and Lake Erie has steel tanks of 150,000 to 500,000 gallons' capacity, their bottoms 21 feet above the rail, with 12-inch mains leading to 10-inch water columns, capable of delivering 2000 gallons a minute.

Even such facilities as these are wholly inadequate to keep the traffic moving on the great trunk lines. On these lines all fast trains are watered from track tanks without stopping. On the New York Central between New York and Buffalo are 14 track tanks, and 10 more between the latter place and Chicago. From each of these tanks from 500,000 to 1,000,000 gallons of water are delivered into locomotive tanks daily.

The usual track tank is pressed out of a single piece of sheet steel from 3/16 to ¼ inch thick, stiffened with a half-round or bar of steel riveted to each upper edge, and supported directly on the ties. The width varies from 19 to 20 inches, the former being the prevailing size. On the New York Central the standard length is 1400 feet; on the Pennsylvania 1500 feet. The depth is strictly limited by the necessity of keeping their tops below the tops of the rails because of the scant clearance of brake rigging, and the impracticability of dapping ties to a depth of more than 2¼ inches. This restricts the depth to 6 to 7½ inches.

To take water from so shallow a trough requires accurate adjustments. The scoop should not scrape the bottom of the trough and it must dip at least 2 inches in the water. The height of tender and scoop may vary an inch between light and loaded weight; the wear of scoop pins and bearings and of tender springs and wheels may cause another variation of ¾ inch, while tests have demonstrated that the pressure of the water against the scoop when running 40 to 60 miles an hour will pull the tender down an inch. Therefore it is necessary to allow for a variation of not less than 2 inches. These tanks are kept filled through several inlets by automatic valves actuated by the change in water level in the trough. Three minutes is the average time allowed for filling a track pan. In winter the pans are heated to prevent freezing by a steam pipe discharging directly into the pan at intervals of 33 feet. The surging due to scooping and filling distributes the heat sufficiently. A boiler of 100 horsepower is required to heat two track pans and furnish power to pump water into them.

While, as already noted, the railroads in numerous instances have incurred great expense to secure a water supply from a distance this would be altogether impossible in all cases. Usually it is absolutely necessary to use whatever local supply is available. Much of the boiler feed water contains salts of lime and magnesium which form a scale on the tubes and boiler surface. Often various other foreign matter is contained. Water in the coal regions contains liberal quantities of sulfide of iron which, when oxidized, forms free sulfuric acid. There are instances on record of such water corroding tubes, fireboxes and boilers so rapidly as to threaten to put busy railroads out of business. This trouble is now obviated by treating the water with soda ash.

Generally speaking, water in eastern territory contains very little foreign matter and boiler tubes will last 15 or 20 years with little attention. In the Middle West the water is hard, while west of the Missouri River and in the Southwest it is hard and also contains alkali which causes a great deal of trouble by foaming. Foaming can usually be controlled by blowing off, but at excessive cost for fuel. Iron Mountain, Neb., is said to be the worst place in the United States, for the boiler water there contains an average of 253 grains of encrusting solids to the gallon. In addition to the encrusting solids raw water from the rivers of the Middle West, often used for locomotives, carry from 5 to 6 pounds of suspended matter, *i.e.*, plain mud, per thousand gallons, which means that a locomotive takes into its boiler from 100 to 120 pounds of mud on a trip.

Five years ago the American Railway Engineering Association estimated that every pound of encrusting matter kept from entering the locomotive boiler meant a saving of 7 cents, taking into account only the cost of fuel, repairs and renewals of flues and boilers and loss of engine time, but not including cost of engine failures which were estimated at $17 each.

The enormous increase in the cost of fuel and labor for boiler repairs since then has given a great impetus to the work of installing water treating plants. It is estimated that there are now 600 railroad water treating plants at which 21,600,000,000 gallons of water are treated annually. This is only 6 per cent of the treatment needed.

As a practical example of what can be accomplished, the Missouri Pacific treated 1,368,305,000 gallons of boiler feed water in 1918, removing 3,589,473 pounds of scale forming material, thereby effecting a saving of $279,843.

Engineering Bulletin No. 3 issued by the U. S. Fuel Administration estimates that the use of hard water in locomotive boilers involves the consumption of 15,000,000 tons of coal more than would be required if the water were softened by proper treatment.

In many ways there has been a marked improvement in the handling of the railroad water supply. Formerly the Superintendent of Bridges and Buildings exercised a sort of casual oversight of water supply. Wherever possible a windmill pumped the water, provided the windmill wasn't broken down. Elsewhere an uneconomic steam plant, often in incompetent hands, did the pumping at extravagant cost.

In recent years a good many electric pumping plants have been installed entirely controlled by floats connected with a switch. One such plant on a Western road has been installed in duplicate so that there may be no failure of supply in case of breakdown. The plant has a capacity of 1,000,000 gallons a day. The old steam plant required a force of 3 men; the electric needs but one man. The current costs no more than fuel for the former plant, so the net saving amounts to $1500 a year. Oil engines of the semi-Diesel type are being extensively installed, a single manufacturer having sold 495 such engines of 9827 aggregate horsepower to railroads in 5 years.

Another saving is being effected by stopping the waste of water which is very great, for the daily consumption average 2,500,000,000 gallons, delivered through innumerable connections under the control of thousands of employees who have no conception of the value of water. There is no such thing as an insignificant waste of water. For example, a 1/16-inch stream, such as may escape through a worn faucet washer will, at 40 pounds' pressure, waste 18,844 gallons a month which at 20 cents a thousand gallons amount to $3.68, enough to buy a new faucet. The Illinois Central, by a continuous campaign against waste of water, has effected a net saving estimated at $326,900 in five years.

WE are quite accustomed to statistics setting before us the vast tonnage of coal used up by our railroads in the course of a year, and to being told how much of this is burned up in hauling more coal for the carriers to operate their regular freight and passenger service with. That coal alone will not make a locomotive go is quite as obvious as the fact that an automobile will not run on gasoline alone, without the proper amount of air and oil and water. But when we hear the truth about the water consumption of America's railroads, the figures are sufficiently startling to justify the length to which Mr. Carter goes in writing about them.—THE EDITOR.

The Divining Rod Made Respectable

Modern Mineral Location That Proceeds Along the Lines of Medieval Magic

By E. F. Cone

AN invention which bids fair to revolutionize mineral prospecting has been announced. Some of the developments are positively startling. In December of last year Mr. Herman A. Holz of New York gave the preliminary details of a new German invention which was described as the old divining rod rendered efficient for the detection of minerals, metals and even crude oil. Mr. Holz, a dealer of the highest standing in scientific instruments of precision, stated that wonderful progress had been made in Europe in the last four or five years, in the utilization of atomic forces; that processes and practical means had been developed to a high state of perfection for definitely locating solid, liquid and gaseous deposits in the earth without boring or prospecting, and even for accurately determining the position, depth, width and thickness of each deposit and for differentiating between the various materials forming the deposit.

The invention has been developed by a German engineer of high standing, who for many years was chief engineer of a prominent boring and drilling company. Mr. Holz personally visited Germany a year ago to investigate and study the invention and the tests to which it had been subjected. He himself located with the apparatus an extensive lead-zinc-silver field in Germany and thoroughly checked all phases of the device.

The principle on which the new instrument is designed is described by Mr. Holz as follows: All materials of mineral origin seem to give off certain emanations, different for each element. The difference probably lies in the speed of the electrons given off, and has some certain relation to the atomic weight of the elements. These variations, carefully studied by the inventor, permit him to differentiate clearly between the various materials forming a deposit, by synchronization of the apparatus to the waves of different form. Thus, if the apparatus is adjusted for lead, it is actuated only by lead; if set for oil, it is acted upon only by oil. The apparatus can be adjusted for practically all useful materials found in the earth, such as all ores, salts, coal, sulfur, asbestos, oil, natural gas, etc. There are several very remarkable features of this process—remarkable, of course, only because so very little is known about the atomic forces utilized.

First of all, the emanations or rays penetrate everything except pure metallic lead. This proves their similarity to X-rays and the radiations given off by radium.

Second, the emanations are given off by the materials at definite, carefully determined, different angles. These known angles are utilized in the practical applications of the process for determining the depth and exact location of the deposit.

Third, some of the rays are perceptible at a distance of 50 miles from the deposit, indicating its presence and general direction from such a distance, thus adding greatly to the practical value of the process in field work.

Fourth, there is no personal element entering into the use of the apparatus; it works equally well and correctly with everybody and repeats its indications exactly at the same spots, thus proving in the most reliable manner the presence of certain forces in definite directions. Mr. Holz says:

"The strength of the atomic forces which act on the apparatus is often surprisingly large. We seem to possess not the slightest idea of the magnitude of some of the forces which are present on earth and which have not yet been explored in this country. I feel certain that systematic research work along these lines would clear up some of the great mysteries with which we are still confronted—the mysteries of electricity, of magnetism, of life. I have reasons to believe that the divining rod, used for over a thousand years and in some cases undoubtedly with success, is acted upon by a few of the rays which are utilized completely and systematically in the highly developed apparatus."

Since the announcement of this remarkable invention, developments have been rapid and startling. Through the efforts of Mr. Holz and his acquaintance with the inventor as well as because of his standing among scientific men, arrangements were made with influential interests in New York for the coming to this country of the inventor for the purpose of thoroughly demonstrating and testing his apparatus. Accordingly early this year the inventor, Philip Scherumly, of Frankfurt am Main, Germany, arrived in the United States and, under the direction of one or two skilled mining engineers, set about his work of proving the claims made for his new device or practical divining rod.

The first test was made among the iron ore fields of the Lake Superior region. Here, through ice and snow several feet thick, the "polarizator," as the new invention is called, located new ore fields said to be worth many thousands of dollars, according to the reports of the engineers. The next trial was in the Pittsburgh district where new pockets of natural gas were looked for. There also, it is reported, the explorations were 100 per cent satisfactory. The last trial was in the oil fields of the southern part of the country. There also it is claimed a 100 per cent record was made in the location of new oil pockets or fields.

The definite result of these trials was the incorporation of a new company to use exclusively in the United States the new instrument, and the payment to the inventor of a large sum for the concession. John Hays Hammond, the well-known American engineer, is one of the most interested men in this movement. The new company is stated not to be a commercial proposition but will be engaged in research and geological studies.

The large economic value of this invention is self-evident; if the expectations of its promoters are realized, it will revolutionize mining methods and reduce the speculative phase of prospecting to a minimum. It should be added that in the operation of this new invention, cartridges of the material sought are placed in the device; the mechanism then synchronizes the emanations, exchange reciprocally, and locates the definite confines of the material in the earth.

Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

Where the Fish Go

To the Editor of the SCIENTIFIC AMERICAN:

I note in your issue of April 2nd a letter by Mr. J. M. T. Hamilton saying that the greatest destroyer of fish next to themselves is the waterfowl. He also condemns the pelican as the worst destroyer and estimates their number at one million. I should like to quote from an article in *American Review of Reviews* for May, 1919, an account of a trip made at the instance of the Federal Food Administration by Mr. T. Gilbert Pearson, Secretary (now President) of the National Association of Audubon Societies, for the purpose of ascertaining how many brown pelicans were living along the coast, and the character of their food. "Here is what we found as to numbers: Of the seventeen islands on the Texas coast said to contain colonies of pelicans, we were able to visit all but one. A group was found breeding on only one of these, and here we found eighteen eggs and thirty-two young. We credited Texas with 5000 birds and went elsewhere. Every foot of the Louisiana coast was cruised and the colonies all visited. We recorded 50,000 for that state. It is the writer's opinion that in June, 1918, the brown pelican population along that 1400-mile strip of coast from Mexico to Key West did not exceed 65,000 adult birds.

"Regarding the food of the pelican at this time (the nesting season), Dr. Hugh M. Smith, Chief of the U. S. Fish Commission, reported that in every specimen sent him that was collected between Rockford, Texas, and Tampa, Fla., was the Gulf menhaden, a fish never used for human consumption. Neither the writer (Mr. Pearson) nor the State's representatives with him could find one single food fish. Of the 3428 specimens taken in Florida waters only twenty-seven individual fish were of a kind ever sold in the markets for food, and not a single specimen of the highly prized varieties, such as trout, mackerel, or pompano, could be discovered in possession of any pelican.

"The Federal Food Administration has felt constrained to say that the charge against the brown pelican has been disproven."

Dongan Hills, S. I., N. Y. C. DEWAR SIMONS, III.

To the Editor of the SCIENTIFIC AMERICAN:

Your issue for April 2, 1921, contains an article signed J. M. T. Hamilton on the subject "Where Some of the Fish Go."

The man who wrote this evidently is unscientific in his observations and inclined to accept loose statements of others and pass them on over his signature as facts. He reports someone as estimating the number of brown pelicans in the South as exceeding one million, and that "each consume a hundred fish a day, making a total of one hundred million destroyed by this one variety of sea-fowl," etc. His inference is that the pelican is extremely destructive to valuable fish.

You will, I think, be interested in the following statement: In the summer of 1919 at the request of the United States Food Commission I visited every known breeding colony of brown pelicans along the gulf coast of the United States. The states of Florida, Louisiana and Texas cooperated by supplying vessels, crews and provisions for the expedition. The undertaking was for the purpose of determining as nearly as possible the number of brown pelicans frequenting our Gulf Coast and also see if they were as destructive to food fishes as was popularly reported.

Every possible precaution was taken to learn the real facts. In each case a State representative was with me visiting the islands and checking up the data. Without going into detail I may state that we found about 65,000 brown pelicans from the mouth of the Rio Grande to Key West and this was after allowing liberally for non-breeding birds that were not frequenting the nesting colonies.

Large quantities of fish disgorged in our presence by pelicans both young and old were forwarded in tanks given us for the purpose, to Dr. Hugh M. Smith head of the Bureau of Fisheries in Washington for identification. Our investigation and Dr. Smith's report revealed the fact that very few food fish are consumed by brown pelicans at this season of the year. From the Mexican border to Tampa Bay, Florida, absolutely every one of the thousands of fish disgorged in our presence were Gulf menhaden, a fish never used for human consumption. From Tampa Bay to Key West of the three thousand, seven hundred and twenty-one (3721) fish collected *only twenty-seven were food fishes.* These consisted of mullet, pig-fish, pin fish and crevalle, all low grade fishes. Any of them sell for 4 cents a pound in the local market.

I need only add that after receiving this report the United States Food Administration refused to take any action looking to the destruction of the brown pelican. While my observations were made entirely in the summer, the United States Department of Agriculture at once took up the work with a view of gathering data throughout the year. While their report has not been made I have been informed privately by those having the matter in charge that the amount of food fishes destroyed by pelicans at all seasons of the year is extremely small when one considers the charges made against the bird.

I am sending you this in the interest of fair play for one of our most interesting birds of our Southern waters. T. GILBERT PEARSON.

New York, N. Y.

Nothing New

To the Editor of the SCIENTIFIC AMERICAN:

It may be worth while to review another anticipation.

Before the recent war you published a short correspondence letter I sent you recommending oppositely revolving parts to cancel gyroscopic interferences.

The all metal Rohrback monoplane used by the Staaken airplane factory appears to be built in this way "symmetrical;" but why did not some person make use of this published suggestion during the war?

Necessity may be the mother of invention, but this does not prove war is a necessity.

Earleigh Heights, Md. J. FRANK GELLETLY.

Another Job for Sawdust

To the Editor of the SCIENTIFIC AMERICAN:

With reference to your article of April 2nd, "Jobs for Sawdust," no doubt there are many of your readers that would be glad to know that about 2 inches of sawdust spread over a very dusty country road will make the road dustless. This has been tried and found to be very satisfactory. In very dry weather the road will have a layer of very fine dust sometimes three or four inches deep. The sawdust will keep it down.

W. A. HOEVEMAN.

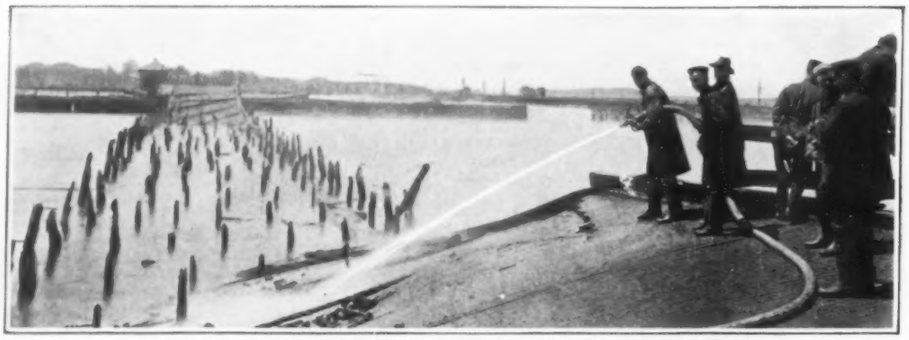
A Bridge Building Record

How Cities, Officials and an Industrial Works Pooled Interests, Cut Red Tape and Met an Emergency

By E. W. Davidson

TO build a wooden bridge 400 feet long and 33 feet wide in ten days for $35,000! Faced with such an order, what would the ordinary—or the extraordinary—bridge contractor do? Gasp? Smile patronizingly?

It can be done. It *was* done. With a great burnt gap in the important Point of Pines bridge between them, Lynn and Revere, Massachusetts, stood on opposite sides of the Saugus River during the early part of July, and saw it happen.



After the early morning fire of June 17th, showing the remains of bridge

The actual time of construction was ten days. Counting in the clearing away of burnt parts before reconstruction could begin, the whole job took exactly 13 days, one hour and twenty minutes. A bare 31 days elapsed between the burning of the old bridge—with firemen hampered by a failure of the bridge standpipes to function—and the throwing back of the gates on July 18 to permit a glad parade of automobiles across the new structure. Traffic on the main highway to the north shore of the Saugus was thus resumed in a minimum of time.

The train of events leading up to this remarkable undertaking started with the fire on June 17th partly destroying the original structure across the Saugus River. That fire broke a vital traffic artery. On the following day the Metropolitan District Commission announced that a new bridge would cost between $60,000 and $150,000 and no funds were available. But in view of the fact that a $50,000 state emergency fund existed, the Commission's engineers started specifications, anyway. On the 21st Lynn, Revere, and the town of Swampscott asked the Commission for a temporary bridge. A hearing was announced on the 23rd and held on the 30th. In the interim, the Commission's engineer had reported that to build a bridge costing $150,000 would mean shutting off travel for six months.

By July 12th all burned piles had been replaced or spliced and each bent capped

This suggestion of delay, with the summer's heavy automobile travel just starting, worried Lynn and Revere not a little. But on the 29th, the day before the Commission's hearing, the big electric company, with works near the Lynn end of the bridge, offered to rebuild the bridge in temporary form at cost within 15 days. Engineers scoffed, but H. S. Baldwin, department engineer of the General Electric, was sure it could be done. That afternoon Mr. Baldwin went out in a rowboat and inspected the ruins. That night complete tentative plans and cost estimates were made.

The next day after the hearing the Commission decided to let the electric company go ahead. The city of Lynn appropriated $40,000 to finance the work and Governor Cox gave assurance that the state would reimburse the city next winter when the Legislature meets.

Detail plans were drawn July 2, the engineers finishing them in the small hours of the next morning, so that they could be given to contractors for bids. The contract was let at $14,200, and the electric company agreed to furnish the materials and supervision for $20,000.

On the morning of July 4 steam derricks appeared at the bridge and work started tearing off the damaged deck and weakened piles. Three days later new construction began.

Storms and heart-breaking obstacles interfered from the start. At first it looked like a month's job. Floodlights were put up and the work drove ahead night and day. As days passed, the outlook grew brighter.

By July 12 all the caps except on six spliced joints at the Lynn end of the bridge were in position. On the 14th it was possible to cross the bridge on the loose planking while the cross bracing went ahead swiftly.

When the job of laying the wearing surface of 2-inch spruce planks began, the workmen were sure that sawing would take ten days to two weeks. An individually motor-driven circular saw table with mitering arrangements operated by two experts was rushed out from the Lynn Works. The planks were cut at the proper angle as fast as they could be fed. The laying of the planks was so swift that Mayor Creamer was able to drive the last spike on the 18th and the bridge was done.

Only the best materials have been put into the structure. The new piles are of oak; the stringers, caps, deck, fence, post and hand rails are of long leaf hard pine and the wearing surface of spruce. 270,000 board feet of lumber have been used and thousands of bolts, made upon order at the General Electric plant, thereby saving time and money, will hold the whole together for years to come. The caps are 8 x 14 inches and the stringers 10 x 16, spanning joints. Instead of a temporary bridge, it is made as well as, if not better than, the original structure and is guaranteed for ten years. Its substantial character may be noted in the lower view.

The completed bridge on July 18th, ten days after actual work began

Getting a Line on Concrete Pipe

LABORATORY investigations involve the making of test rings of pipe 6 inches long and of the desired diameter. They correspond to sections of the pipe as built in factories. The making of rings for testing purposes necessitated the designing of a special machine capable of not only regulating the pressure exerted by tamping but in measuring its intensity. Such is possible by extending the core 2½ feet above the outer form, which acts as a guide for the tamper. The latter, a cast-iron shell 7 inches high, with handles permitting its elevation, is allowed to drop by gravity on the materials between the forms a certain number of strokes, so as to apply the proper test.

The testing machine employed in breaking the rings is described as a rubber bag which fits inside the rings, the open ends being bulkheaded. Water is forced into the bag slowly until the enclosed air makes a get-away, after which pressure is applied gradually until the specimen subjected to the test breaks. The apparatus is said to yield satisfactory results, uniformity being obtained to a surprising degree. The achievement is accredited in a major degree to the fact that the water pressure within the bag and against the bulkheads keeps the latter free from the shell of the ring. Here is a notable illustration of the strength of concrete pipe, testifying to the value of choice materials: Six-inch rings, 28 days after being manufactured, withstood an internal pressure of 230 pounds to the square inch or an equivalent tensile strength in the shell of over 700 pounds per square inch. The specimens were properly graded and evidenced a ratio of one of cement to three of aggregates. This speaks well for concrete pipe, which is so simple to make.

Start of the Bearcat class of runabouts

Harmsworth Cup Remains in America

THE International Motor Boat Race for 1921 brought two boats to the line that were remarkable for the enormous horsepower of the engines which had been crowded into their frail hulls. One of these "Miss America II," an enlarged edition of "Miss America I," was a typical "Gar" Wood craft, a hydroplane with a single step, built of wood and of extremely light construction. Her motive power consists of four modified Liberty engines with a maximum power, each, of 450 horsepower, the total horsepower available being thus about 1800. "Maple Leaf VII," unlike her predecessors, which were displacement craft, is a single-step hydroplane equipped with four engines of even greater horsepower than those of "Miss America II," the total being given as between 1800 and 2000.

The race was held on Labor Day, September 5th, in the Detroit River, distance 40 nautical miles. "Maple Leaf VII" was first across the line, but as they came around on the first lap "Miss America I" had taken the lead with "Miss America II" twelve seconds behind. "Maple Leaf VII" was third and "Miss Chicago" fourth. "Maple Leaf VII" sprung a leak and had to withdraw, sinking shortly afterward.

The race was won by "Misss America II," which covered the course of forty nautical miles at a rate of speed which on the fourth lap slightly exceeded 71 miles per hour.

In the race for the Lake George trophy for the one-mile speed-boat championship of North America, Garfield A. Wood's boat won again. The course consisted of six runs over a measured mile, three with and three against the stream. The fastest mile with the current was done in 44.13 seconds and the fastest against it in 45.05 seconds, the average being just under 80¾ miles an hour; nearly equal to the fastest railroad speed.

Bacteria Being Killed by Magnetic Fields

CURIOUS effects have been incidentally observed by a well-known Swiss engineer, Mr. E. K. Müller, of Zurich, while treating rheumatic and nervous complaints by the application of magnetic fields, changing direction about 100 times per second. In fact, any infectious diseases his patients happened to be affected with would undergo a most beneficial influence, severe colds disappearing in a surprisingly short time—sometimes in a day or so. When this state of affairs became known, some families of mountaineers from the Engadine would every year in the fall come down to Zurich to undergo a treatment at Müller's laboratory, after which they invariably declared having spent a much better winter than otherwise, a winter without catarrhs and influenza. Some remarkable cures of tuberculosis having likewise been involuntarily effected, Müller undertook some experiments with a view directly to examining these striking phenomena.

The apparatus used in this connection was the same as used for therapeutic purposes, viz., a coil of wire traversed by a relatively strong alternating current (30-40 amperes, 120 volts, 100 periods per second) and comprising in its interior a specially designed iron core. A chemist specialized in the physiology of fermentation helped with these experiments, which were made in a laboratory where the conditions of temperature and light could be well checked and kept practically constant.

Fermentation bacteria were found to be arrested in their development by the action of magnetic radiation, whereas experiments on luminous bacteria gave rather unexpected results, their growth being either checked or promoted by the magnetic field, according to the way the apparatus was arranged. The most remarkable result, however, was that the "feeding medium" containing the bacteria would, under the action of the alternating magnetic field, become immunised against any further infection.

Some striking series of tests on luminous bacteria have been recorded on plates. One illustrates the variable blackening of the photographic plate by the light of bacteria exposed either outside of any magnetic field, or in a stationary magnetic field, as produced by a steel magnet, or in an alternating field, as produced by the coil of wire above referred to.

Three "gratings" cut out of double tin-foil were in a light-tight box, placed on a photographic plate, three glass bulbs containing the feeding gelatine with luminous bacteria (pseudo-lucifera) being applied to these "gratings." By stirring the glass bulbs the feeding gelatine was distributed uniformly and made to cling to the glass walls. The outer surfaces of the glass bulbs were ground level, thus enabling the bacteria cultures to be observed in the microscope.

After 24 hours' action of the bacteria, the plate between the cuttings was found to be blackened, the interesting fact being incidentally noted that the light of the bacteria had passed through the double layer of tin-foil. The effect was least marked in grating I (not exposed to any magnetic field), somewhat stronger in grating II (exposed to the south pole of a steel magnet), and most intense in grating III (exposed to an alternating field).

Another plate shows two glass bulbs of the size of a watch, containing luminous bacteria and exposed to no magnetic field, and to the field of the south pole of a strong steel magnet, respectively, the bactericidal effect in this case being very striking.

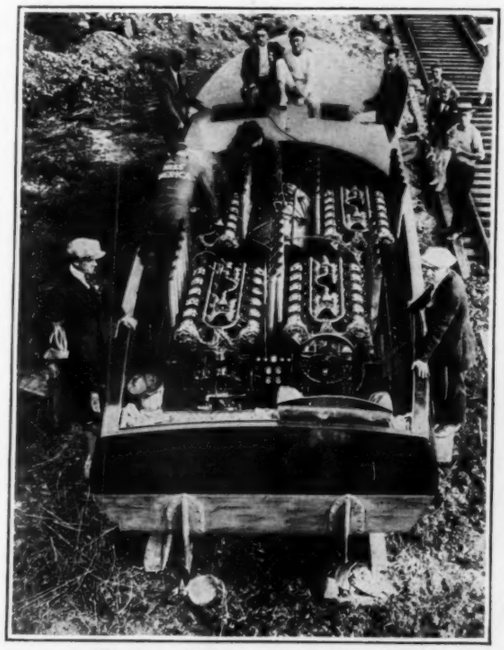
These experiments would seem to confirm the fact brought out by common experience at Mr. Müller's laboratory that organs infected by bacteria are made more resistant by a magnetic treatment.

A New Telescope

A SWISS inventor named Rosing is reported to have constructed a "light-electric" cell for telescopic purposes, which responds to variations of light much more rapidly than any selenium cell thus far invented and which possesses the great advantage of not being subject to "fatigue."

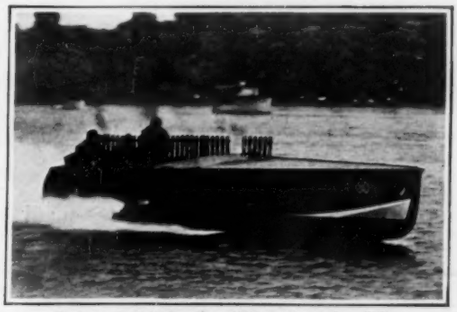
This cell which is already in use for practical purposes in Rosing's telescope, consists of a hollow ball filled with rarefied hydrogen or helium. Upon one side it is covered with sodium amalgam or potassium amalgam, while upon the opposite side it is provided with a platinum electrode. When the amalgam surface receives a negative electric charge and is afterward illuminated an immediate discharge takes place; the electric current connecting the two electrodes can pass from the platinum electrode to the amalgam. Hence as a result of the illumination it is able to overcome the resistance with which it was formerly unable to cope.

According to the experiments made by Rhigi and Stroletow the strength of the photoelectric current which is here operative corresponds precisely to the intensity of the light. Indeed, it follows the variations of intensity in the illumination so exactly that the most peculiar effects can be obtained; for example, by the use of an intermittent light. The inventor calls this instrument an "elektroskop." This new apparatus is now being tested by Marconi in his wireless telephony experiments.



The four 500-horsepower engines of "Maple Leaf VII"

British challenger, "Maple Leaf VII"



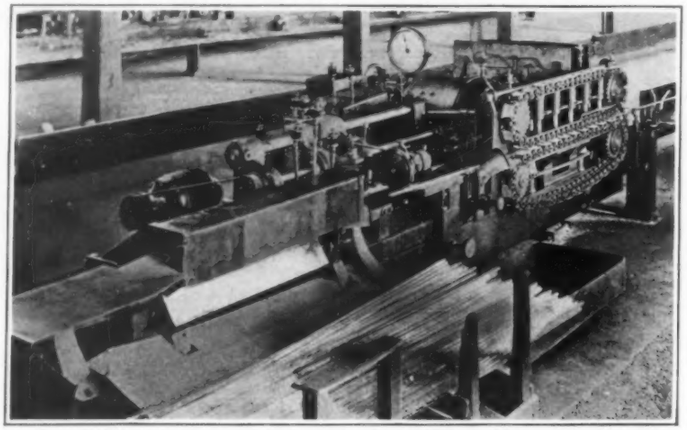
Successful defender, "Miss America II"; horsepower, 1800

Glass Tubes by Machine

How Handwork Has Been Eliminated from a Task Formerly Done Altogether by Hand

MACHINERY is nowadays being applied to all kinds of service. There is, in fact, scarcely a broad line of activity into which mechanical methods have not gone. Some have been more conservative than others; and amongst these one may perhaps list the business of manufacturing glass articles. In recent years, however, even this field has been invaded, and now it appears as if machine processes were about to carry everything before them.

One of the particular lines of glass manufacture that is even now in process of yielding to the general spirit of the times is that which concerns itself with the production of glass tubing. The writer was recently in a large works in southern New Jersey where three machines were already installed and another was just about being put in—machines whose business it is to produce glass tubes by an automatic procedure. No hand is required to touch the glass from the great tank furnace where a great body of molten glass is produced up to the point where tubes five or six feet long are rolled down onto a pile. No hand takes the glass from the furnace, no hand conveys it to the great blow-pipe, no hand forms it on the end of this blow-pipe, no hand pulls it off and draws the new tubing along, and no hand severs into short lengths the tubing as it perpetually comes on. The machine, or rather plant, is very automatic indeed.



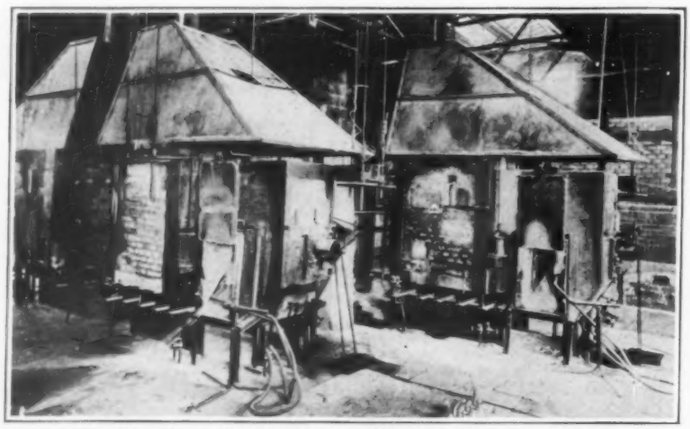
Close-up of the tube-drawing machine, showing position of the saw immediately after cutting the tube to length

Glass tubing is wanted for a number of purposes. Thus, it is largely used as stock from which vials are manufactured. Then, it is used for making up various articles used in chemical laboratories. Cut up into short lengths, it supplies the blanks from which the steam-gages used on boilers are made. The fact that a manufacturer produces tubing does not necessarily mean that he sells it all. He may use it himself in making up many articles. However, it is desirable to produce the tubing accurately in such diameters and such wall thicknesses as may be specified. Naturally, these dimensions can not be controlled with anything like the precision possible in manufacturing, say, cold drawn steel tubing. At the same time, a good deal of accuracy is required. This is particularly the case where steam-gage tubes are to be produced for railroad companies. The outside diameter may be required to be not more than 1/32-inch greater or smaller than specified. The factories have found it difficult to meet requirements as severe as this, and consequently there has been a large amount of waste. This is particularly so where hand methods of tube drawing are depended upon. It is perhaps too early to say whether the machine will readily meet the difficulty in the end. After some rather close attention to the matter, the writer thinks that the machine process should lend itself more easily to accuracy than the hand method.

The advantages of the machine, however, are perhaps rather to be found along other lines. Perhaps the chief of these centers in the *continuity* of the new procedure. The glass tubing comes on all the time. It is perpetually cut off at the end, but it still comes on. This is quite a contrast to what occurs in the old method.

In order to get a good, clear idea of the machine process, it will be well to have before us a brief statement of the old-time way of doing things. Imagine, then, a big circular furnace with eight or ten openings, and a pot of molten glass corresponding to every other one. A man gets on the end of his blow-pipe a gob of the material. It may be necessary, later, to get additional glass by introducing the blow-pipe and the gob already on it. The gob is roughly molded by manipulating it on a half mold kept cool by water. The man blows into the blow-pipe and creates a central hollow in the gob. The glass is manipulated on a flat slab called a marver for the purpose of giving it a conical side surface. It is desirable to manage things so that the cavity will have the glass equally disposed about it. When the amount of glass is big enough, the cavity deep enough, and the disposal of material round it perfect enough, blow-pipe and gob are carried to the vicinity of the walk or runway where the tube is to be drawn. A small furnace, called a "glory-hole," is set up near by. Here the gob is reheated preparatory to the drawing. Two men handle this work, the more skillful one retaining possession of the blow-pipe. The other man secures a hold on the gob by means of an instrument called a punty. This is a rod with a disk at one end, the disk having the rod perpendicular to it at the center. The man holds the rod as if it were a handle, the clear face of the disk having previously been made to cling against the surface of the gob. It is quite important that the punty disk be affixed just right in order to retain its hold.

The tube is drawn by the man with the punty. He simply backs off down the walk, holding onto, and perhaps manipulating, the punty. The man with the blow-pipe blows into it and stands still. The result is that a shell of hot glass flows off the end of the blow-pipe, this shell rapidly diminishing in diameter for a while. Soon, however, the cooling glass in the shell nearer the punty has acquired sufficient stiffness to resist reduction in diameter. That is to say, at a little distance from the gob, the glass will get approximately its final diameter and will not reduce much as the punty man continues his retreat. The yielding is nearly all done at and near the gob and perhaps at and near the punty. In between, lies the tube. It may be possible for the punty man to withdraw 100 or more feet. There will be waste at both ends.



The reheating end of the furnace, showing troughs and arbor

The machine method in part imitates this procedure. The molten glass in the great tank is allowed an exit into a special furnace, in connection with which the blow-pipe is mounted. The glass flows into a short trough with one or more descending steps. Near the further end, the blow-pipe is mounted. But the vertical plane of the blow-pipe is transverse to the line of the trough. The trough has a delivery end, by means of which it sends the glass into the blow-pipe at an angle. The blow-pipe is rotatably mounted at its rear end in a wall of the special furnace. It also dips forward. The result of the stream of glass flowing on at an angle is that gravity and rotation combine to cause the end of the blow-pipe to receive a complete envelope of glass down to its tip. Pressure air is introduced into the blow-pipe and it flows out at the end. This air has only a very mild pressure, however, as the glass shell needs but little assistance to prevent collapse. It is, in fact, understood that pressure air may, under favorable circumstances, not be required at all. On the other hand, the machine may be used for the drawing of glass rod. In this case, it is proper to close the end of the blow-pipe with a cap. The special furnace is provided with a means of heating the glass as it flows along the short trough with its stepped bottom and a separate means of heating the glass on the blow-pipe.

The end of the blow-pipe is preferably furnished with a sheath of heat-resisting material. Consequently, the glass really flows onto it. Further, a kind of muffle may be used for the purpose of equalizing the heat round the glass on the blow-pipe and of hindering the products of combustion from attacking the gob. When used, this muffle may be rotatably mounted, the rotation then operating to distribute heat.

When the glass tubing passes down and away from the special furnace, it soon finds itself on a long line of grooved wheels. These are near the floor of the shop. The tubing lies in their grooves as it moves on away from the furnace. Every other one of these wheels may have its supporting upright provided with asbestos guides. These are to prevent the tubing from riding up out of the grooves and off onto the floor.

At a considerable distance from the furnace, say, 125 or 140 feet, the tubing enters a pulling machine. This, together with the cutting-off device at its forward end, is quite an intricate affair. The pull on the tubing is effected, in part, by the co-action of two endless chains, one set vertically above the other. A little reflection will, perhaps, convince the reader that this is not so simple a matter as, at first sight, it may appear. The glass tubing is to be pulled along at a rate capable of adjustment. The size of this tubing will vary from job to job. This means that some method of adjusting the space between the two chains will be required. Then the grip in which the tubing is held must not be a rigid one. It needs to yield upon occasion. Naturally, it will hardly do to let the chains exert much pressure on the tubing between them at one end of the machine where one sprocket wheel is above another nor at the other end where a similar condition exists. At any rate, in the present apparatus, the grip on the tubing is effected in the region between the two pairs of end sprockets.

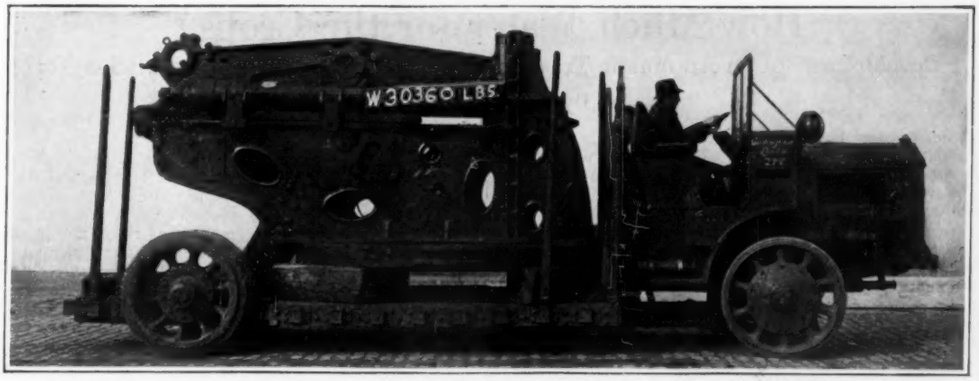
The links of each chain are pivoted to one another. Half way between the ends of each link and inside the side straps of the link is arranged a roller. The function of these rollers will soon appear. There is a kind of saddle which extends longitudinally over each pivot-joint. This saddle is carried by the shafts or trunnions of two rollers. The saddles are arranged to cover the joints on the *outside* of the chain loop. They accordingly lie between the chains and the tubing as they pass through the region where the grip is effected. In fact, when these saddles are suitably provided with cushions they constitute the means of gripping and pulling the tubing.

However, it is necessary to force them to their duty. Otherwise, there would be no effective grip developed. This is done by providing two platforms, one above and the other underneath the working parts of the two endless chains. As the chains pass between the two platforms, each contacts with its platform by means of its rollers. They are the wheels which enable the chains to pass over the platforms without developing sliding friction. The under platform is unyielding and it is fixed in position. In effect, this provides a definite

level for the passing tube. The upper platform is divided into sections and these yield more or less. This upper platform is also adjustable vertically, and this takes care of the changes in size of the work that may be desired from time to time. The upper pair of sprockets may also be adjusted vertically. The arrangements are such that both upper sprockets are raised and depressed simultaneously and at the same rate. This is accomplished by means of a long shaft and of bevel gears. The pulling machine is operated by a suitable motor mounted on the carriage which supports the whole.

From the point of view of mechanical engineering, the cutting off device is perhaps the most notable feature of the entire plant. Off-hand, one might think it quite a simple matter to cut off a continually lengthening tube every time it grows six feet longer. But if one reflects a little, he will soon grant perhaps that unless the notching or cutting or breaking or any combination of these is done instantaneously, it may be necessary to *accompany* the continually lengthening tube. In the present device, one of the main operations of the severing is a notching with a rapidly rotating wheel. This wheel must dip and pause, as it were, and during the pause nick the glass with its flying edge. The pause here refers to the matter of approach to and recession from the surface of the glass. This pause means that the nicking is not done instantaneously, but that time is a factor. Now in order that the wheel may even for a short time stay with the tube at a given point, it must travel with the tube. The mechanism must therefore not only provide for the approach and recession but also for a movement with the motion of the tube. So the notch is made.

A wheel consisting of a series of long vanes receives the tube as it grows, the end being in between two of the vanes. When the break is made by a movement of the slotted disc forming one end of the system of vanes, the desired length of tube is already all the way in between a pair of vanes. Cut off, it rolls on one vane by gravity and escapes from the machine.



A man's-sized job for any truck—hauling a six-inch disappearing-gun mount, an aggregate load of 30,360 pounds

A Departure from Motor Truck Conventionalities

THE accompanying photos show a new motor truck with many novel features that is now being manufactured in San Francisco. Among the special features are hydraulic steering, three-point suspension and spring-mounted power-plant.

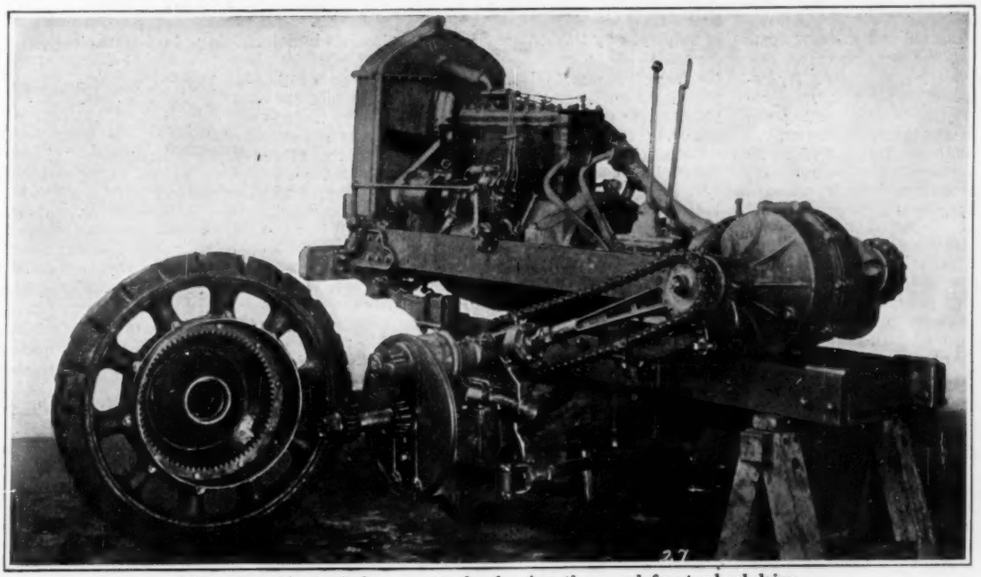
Using the regular steering-wheel principle, the hydraulic system connects the steering wheel to a simple hydraulic control which works automatically. The truck carrying a load of ten tons can be steered as easily as a passenger car. The driver can throw the wheels of a loaded truck from extreme to extreme with the vehicle standing still, without any physical effort other than the effort to move the steering wheel. The pneumatic steering device consists of a cylinder attached to the right side of the truck in front of the front wheels. This turns the front wheels as easily when the truck is motionless as when in motion, enabling the truck to be maneuvered into the most advantageous loading position under any conditions, without loss of time.

The main or load carrying frame is mounted on three points. This eliminates all frame distortion or weaving—one of the most destructive weakness to be met with in motor truck construction.

The spring-mounted power-plant has a great advantage because it protects the power plant against all shocks of road inequality, shifting load or careless driving. This makes for longer mechanical life and increased driving comfort.

The service brakes are instantly, positively and powerfully set by a simple application of the hydraulic principle.

Another feature of this truck is the unusually low-hung body. This truck is said to possess the lowest body of any truck manufactured, the bed being only 18 inches above the ground. This is made possible by the arrangement of the engine suspension in company with the front-wheel drive. Any doubts as to the practicability of the front-wheel drive should be dispelled by the photograph at the head of the page, showing the new truck successfully performing a decidedly heavy bit of hauling.



The power plant of the new truck, showing the novel front-wheel-drive

Protecting Fruit by Colored Light

A FEW years ago there was a good deal of excitement roused among the public by tales of the marvelous effects upon the general health and well being produced by exposure to blue light. More recently some very interesting experiments have been carried out with respect to the effect produced upon the growth and development of plants by various colors. Naturally, however, it would be out of the question to roof large areas of land with glass of one or another color in order to produce a given effect. An ingenious French botanist, M. Robert Lance, however, has gotten around this difficulty in a very clever manner by coating grapes and other fruits which it is desired to protect, with a solution containing a harmless blue coloring matter.

M. Lance's method is particularly designed to prevent fungus growths by means of a colored screen. He creates this screen by spraying the leaves, stalks, flowers, and fruits of the plants he wishes to protect with a clear solution which is obtained by adding green, blue, indigo, or violet dyes to water containing a support, such as sulfate of lime, lime, talcum, kaolin, etc., to which the dyes in question are attached by means of freshly precipitated alumina (alumina is a single oxide of aluminum).

M. Lance especially recommends a solution prepared as follows: Ultra-marine blue, 650 gr.; ultra-marine green, 250 gr.; ultra-marine violet, 100 gr. These amounts of the three shades of ultra-marine are diluted with several liters of water and to dilute solution 2 kg. of sulfate of lime are added, besides 1350 gr. to 1400 gr. of pulverized quick lime. When the mass has attained a uniform color the dyes are attached to the base as a sort of lacquer by incorporating 1 kg. of sulfate of alumina or else 1.5 kg. of alum. The lime decomposes the sulfate of alumina or the alum, setting free the alumina which at once fixes the color upon the particles which are meant to support it, and at the same time gives more adhesive power. When the reaction is finished enough water is added to bring the volume to 400 liters and the mixture is then ready to be sprayed on.

M. Lance has modified this method for use in certain cases by adding to the spray an anti-cryptogamic substance. Zinc chloride and zinc sulfate are well known in medicine as antiseptics, so that if sulfate of zinc be added to the solution the latter will be even better as a germicide. To prepare this solution 1 kg. of sulfate of zinc is dissolved in 100 liters of water. 500 gr. of pulverized lime are added in order to precipitate the zinc in the state of the hydroxide and to decompose eventually the total amount of the alumina salt employed as a fixative; then with the mass thus obtained from 80 gr. 100 gr. of the dye stuff is incorporated. When this is done 250 gr. of sulfate of alumina or 375 gr. of alum are added, and the mixture is stirred vigorously for a quarter of an hour; it is then filtered, after which it is ready to use as a spray.—By *M. Tevis.*

Effects of Fire on Concrete

WITHIN six months two fires with similar characteristics occurred in a reinforced concrete warehouse at Galveston, Texas, according to an article in an American engineering paper, the observations of two engineer eye-witnesses on the behavior of the structure, with their conclusions, is as follows:

"The warehouse was a two-story building divided by 12-inch walls into independent sections 300 feet long. The design is simple, comprising 22-inch and 16-inch diameter columns spaced at 20-foot centers reinforced with vertical rods and spirals supporting flat slabs. The first floor was 9 to 12 inches thick with 4-inch drop head 6 feet square. The roof was 6 to 8 inches thick with 3-inch drop head. The floor loads of hemp were exceedingly heavy and in burning developed great heat. In the first fire the floor stood. In the second fire noticeable facts were the complete destruction of drop heads though adjoining flat slab was intact, and the weakness of construction joints in offering resistance to fire. The results of these fires show conclusively the great value of flat surfaces without sharp corners of any kind. Spandrel beams over doors were almost completely destroyed, although flat slabs adjoining remained nearly intact. Drop heads and beams suffered similarly."

How Much Water for the Crops?

Development of an Automatic Transpiration Balance by Government Scientists

By George H. Dacy

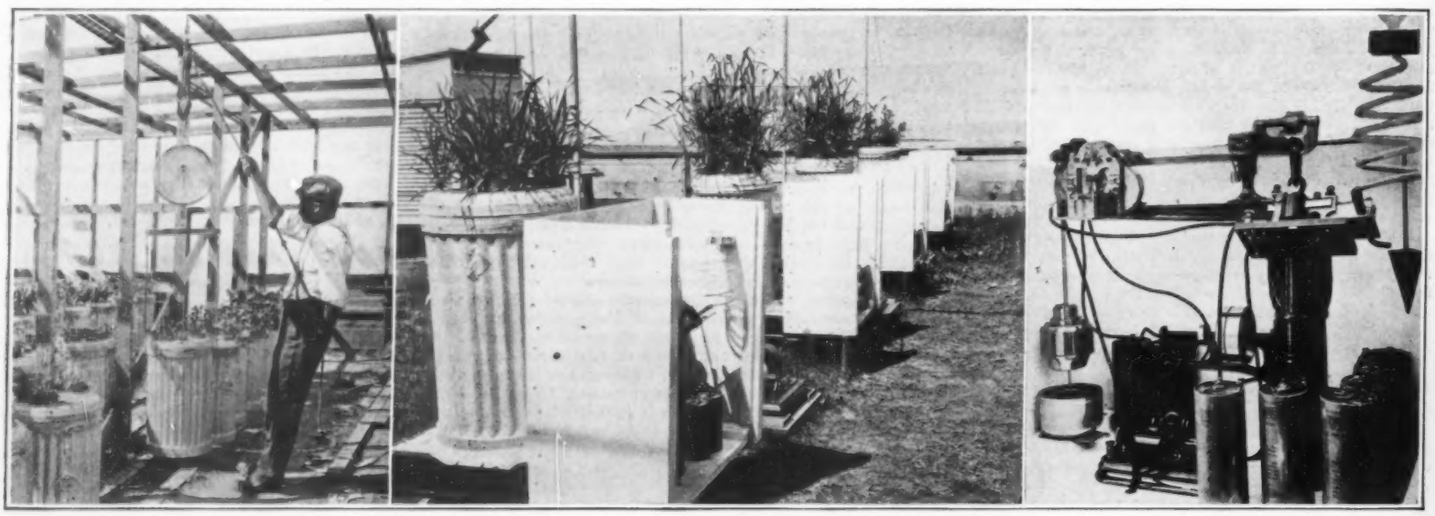
AN ingenious automatic transpiration balance has been devised by the scientists of the National Department of Agriculture who are conducting investigations to ascertain the water requirements of various kinds of plants. The water requirements of a given crop, or the transpiration ratio, has long been known not to be constant, but to be dependent on and influenced by variations in many environmental factors, such as the temperature and humidity of the air, the velocity of wind, the intensity of solar radiation and the fertility of the soil. The water requirement of small grain crops grown in a cool, humid region is much lower than that of the same crops when grown in a dry region, such as the western part of the Great Plains, where they are subjected also to high winds and great solar radiation. The matter of the water requirements of plants is of great economic importance in connection with the agriculture of the semi-arid regions, since the crop or variety which is most economical in the use of water, other things being equal, is evidently the one best adapted to regions having a limited water supply.

Heretofore, plant transpiration experiments have been conducted under great difficulties, as hand spring balances have been used to weigh the growing plants potted in special galvanized containers in order to keep tab on the amount of water they received and the amounts they transpired or which evaporated. By using galvanized containers with close fitting covers provided with openings for the plants and sealing the openings around the stems of the plants with wax, the national farming experts eliminated the loss of water due to evaporation. The large pots of plants were weighed once daily and were maintained in a screened inclosure to protect the experimental plants against birds and possible hailstorms. These tests have shown that alfalfa is far higher in its water requirement than most of the other popular farm crops. It requires double the amount of water that wheat and other small grains do, three times as much as corn and four times as much as millet or sorghum. These results indicate the impracticability of growing alfalfa in regions of limited rainfall when forage crops like sorghum or millet are available which will produce the same amount of dry matter with one-fourth the amount of water. Varieties of the same crop show measurable differences in their water requirements. This suggests the possibility of developing strains which are much more efficient in the use of water than those now grown in the dry-land regions.

The new automatic weighing apparatus devised by Uncle Sam's expert agriculturists is so arranged that the experimental plants can be exposed freely and continuously to the weather. A small platform scale with agate bearings having a carrying capacity of 200 kgm. and a sensibility of 5 gm. is used as the foundation of the automatic apparatus. This scale was fitted with a short column so as to centralize all the mechanism below the level of the top of the pot in which the test plants were grown. The auxiliary equipment of the automatic balance consists of a special, ball-dropping device, a ball receiver on the beam, beam contact and mercury cups, oil dashpot on the beam, a spring motor for raising the beam, an adjustable counterpoise for raising the center of gravity of the balanced system, a recorder for registering the exact time at which each ball is dropped, batteries and relays and a case for protecting the mechanism from the weather. The operation of the mechanism is simple and efficient. As the plant decreases in weight due to transpiration, the beam of the scale falls until an electric contact is established at the front end of the scale. This closes a special relay circuit with the result that the ball-dropping device deposits a ball in the conical cup shown in one of the accompanying illustrations. The weight of this ball tends to raise the scale beam. The spring motor by means of a special cam arrangement raises the beam promptly and positively to its upper position and as this is done, the time of the event is indicated on the drum of the recorder.

The conical ball receiver is suspended from an extension of the scale beam on the same side as the plant load so that the added weight of the ball compensates for the loss which the plant suffers by transpiration. The ball receiver is suspended from a knife-edge which lies in the plane determined by two other knife-edges on the beam. The distance from the central knife-edge is so chosen that the weight of the ball corresponds to a change of 20 gm. in the weight on the scale platform. The dropping of a ball into the receiver is ordinarily sufficient to raise the opposite end of the beam and open the circuit. It sometimes happens, however, when the transpiration rate is high and a gusty wind is blowing, that the beam remains down until the transpiration has been sufficient to require a second ball to counterbalance the loss in weight suffered by the plant. Under such conditions the balance would fail to operate without the intervention of some protective device. This protection is secured by a spring motor which raises the beam to its upper position each time a ball is dropped and then leaves the beam free. The motor which consists of a strong 8-day clock movement equipped with a fan to reduce the speed is controlled by an electro-magnet. When the beam circuit is closed, this motor is released and raises the beam by means of the cam. When the cam shaft has completed one revolution, the arm on the cam shaft again engages the spring on the armature of the magnet and the motor is stopped.

A convenient type of recorder for registering the time at which each ball is delivered has been devised by Doctor Marvin, Chief of the U. S. Weather Bureau, for use in connection with automatic rain gages. This recorder has a drum 12 inches in circumference which makes one revolution in six hours and is continuously offset by a screw so that the four 6-hour periods are recorded side by side on the same sheet. A valuable feature is a zigzag attachment on the magnet by means of which the tracing pan is permanently displaced each time the magnet circuit is closed. This gives a graph which is much easier to read than the ordinary record in which the pen returns to its initial position when the circuit is opened. The dropping of two balls in rapid succession is easily seen in the zigzag record on account of the double offset but is difficult to determine in a record of the ordinary type. The automatic transpiration balance works very satisfactorily except in the presence of whirlwinds or sudden gusts which lift the experimental plants and tend to give a transpiration rate which is momentarily too high. The use of this novel apparatus is aiding our Federal farming experts to ascertain facts about the water requirements of plants which previously have been impossible of determination owing to the lack of a satisfactory and efficient experimental apparatus.



Left: Unsatisfactory and cumbersome old-fashioned method of conducting plant transpiration tests. *Center:* Four automatic balances used in investigation by Government farming scientists. These machines accurately record the transpiration losses of plants as they grow. *Right:* Front of balance with cover removed, showing mechanism. The spiral glass ball container is noticeable in the upper right-hand corner, the balls passing down through the ball dropper into the basket at the extreme right. The spring motor for raising the beam is shown at upper left-hand side. The dashpot appears below the weight carrier

The old and the new apparatus employed by Government farming scientists in determining plant transpiration

How Long Can You Hold Your Breath?

WHILE Nature has wisely made our heart action involuntary she allows us to have a certain amount of control over the equally important function of respiration. This is doubtless because it is not infrequently of advantage, as in case of danger of suffocation from smoke, water, noxious gases, etc. The time during which one can hold the breath is extremely brief, however, even at best. According to some recent experiments by two French physiologists, MM. L. Binet and M. Bourgeois, reported in the *Presse Médicale* (Paris) for June 12, 1920, this is not more than 40 to 45 seconds for a normal adult in a state of rest, or a little bit longer if the person is lying down. This time can be considerably increased by training as in the case of expert divers.

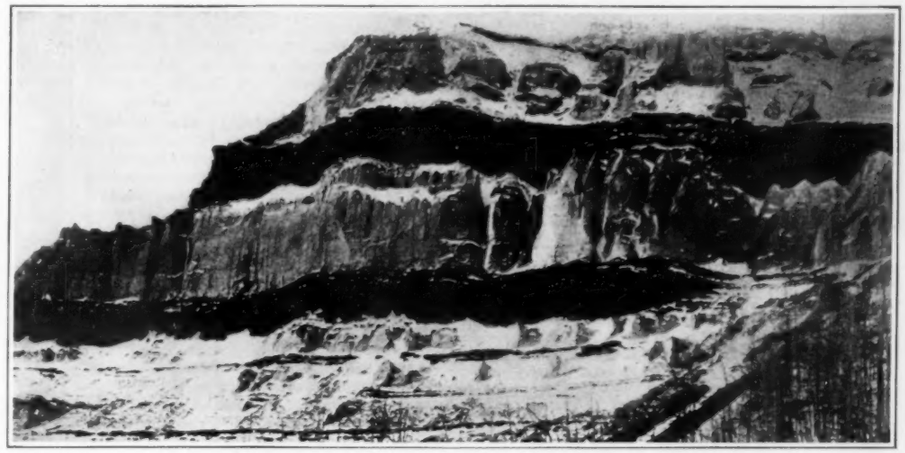
But the most important result of these experiments is the demonstration that the capacity for holding the breath is affected by disease of the air passages or of the heart in such a manner as to form a valuable means of diagnosis. In cases of chronic bronchitis, for example, the patient is rarely able to hold the breath for more than 20 seconds, while in tuberculosis it may be reduced to 15 seconds, even in comparatively early stages of the disease. Similar observations were made in cardiac affections.

The Giant's Causeway

ONCE upon a time, in the northeast corner of Ireland, where the Emerald Isle faces the coast of Scotland across a comparatively narrow expanse of St. Patrick's Channel, there dwelt a mighty giant. And by a curious coincidence the corner of Scotland nearest to his domicile was inhabited by a Scotch giant, of equally forbidding appearance. The Irish giant got to worrying about which of the two of them was the better man and he worried about it until he decided that the question would have to be settled one way or the other. So he shouted across to the Scotch giant a challenge to come over and fight him. The canny Scotchman expressed an entire willingness to oblige, but pointed out that he had no way of crossing the channel. The Irish giant then said that he would build him a bridge to cross on, if he would for sure cross on it and fight: and to this the Scotch giant agreed. So the Irish member got himself to work, and constructed a tremendous causeway of solid columns clear across the water to Scotland: and when it was done, the Scotch giant crossed over and the big fight was pulled off. Press facilities at that time were not what they are today, so there is no certain indication who won the fight —it all depends upon whether it is an Irishman or Scotchman who tells the story. But this much is certain: the causeway that the Irish giant built for his adversary to come over on is still there, and anybody may inspect it who doubts the accuracy of the story and wishes to see the evidence for himself.

To abandon the field of romance and come down to that of geology, the north coast of the County Antrim is notable for the promontory of columnar basalt to which the legend retailed above has given the name of Giant's Causeway. These pillars are close-fitting, irregular hexagons in section, and made up of jointed lifts varying from a few inches in height to some few feet. These portions are convex or concave at their upper or lower ends, so that they fit neatly into one another; so far as we know no exploration has ever determined the depth to which the formation persists, though some of the pillars are exposed for as much as twenty feet of their length. The causeway is from 20 to 40 feet wide, and highest in its narrowest point. It extends outward from the cliff into the water, its upper surface taking a slight downward slant but one insufficient to make walking on it difficult; and after 100 yards that is always above water it reaches a height where it is submerged at high tide, and then runs on out until it is completely lost beneath the water — and beyond. The neighboring cliffs exhibit in many places the same formation. So extraordinary is this formation that at least one standard authority describes it while exercising extreme care not to express the slightest opinion as to its origin. In spite of this non-committal attitude, the Causeway may be characterized as volcanic in origin and lavatic in composition. Just what induced the molten matter to solidify in this curious columnar form, however, must remain more or less of a mystery.

We have a recollection of having read, in support of the legend, that the coast of Scotland shows mild outcroppings of the same formation; but at the moment we are unable to verify this. Perhaps the Scotch giant did some bridge buildng as well.



Where Alaska's coal outcrops in two forty-foot veins

Copyright E. M. Newman

The Giant's Causeway, in the north of Ireland—a natural formation of extraordinary character

Planting Onion Sets by Machine

IN the Pleasant Valley onion district of Iowa, onion sets will be planted the coming season by machine. This machine plants the sets ten times as fast as a man does. Mechanically, the designing of a planter which would handle onion sets presented no great problems; the difficulty, indeed, was of another color. A machine which could distinguish between the top and bottom of a set was obviously impossible. Growers, however, had always planted their sets "right side up."

The feasibility of an onion set planter, accordingly, hinged on the question of whether or not the way a set was placed in the ground mattered. The machine would not only necessarily drop sets sometimes bottom-side-up—others would be left in all conceivable positions. For four years experiments at Pleasant Valley have been under way to settle this question definitely once and for all.

These investigations have demonstrated that it makes no difference how the set is dropped in the ground. This is in the production of globe onions, which is the commercial crop at Pleasant Valley. For "green onions" or "spring onions," it is still desirable that the sets be placed by hand.

Most of the onions Americans eat are grown from seed, not from sets. So, in the first place, the desirability of an onion set machine planter hinged on the desirability of sets. Sets have come into general use in this Iowa district because of an onion pest, thrips. Onions from seed became more and more uncertain. As sets began to be used, seed onions became more uncertain still, because thrips would migrate from set-planted fields to the later onions growing from seed. All these things are behind the adoption this year of a machine planter for sets.

Alaska's Coal Fields

ONE of the elements that makes it almost futile to estimate the length of the period during which the human race will have coal available to meet its power and heating needs is the existence of deposits that have never been worked. All over the world these are to be found; and naturally, little is known about the character of the coal that they will give or the amount that we may hope to extract from them. They vary in size from the one-man deposit in a country where coal-mining is not generally indulged in—in eastern Ohio it is an unfortunate farmer who has not got on his land at least one coal outcrop which he could work if he wanted to—to the millions of tons known to underlie a large part of the area of China.

Among the deposits of this character that should be of more immediate interest are those of our own northern province of Alaska. It is estimated that these coal fields cover some 20,000 square miles; and it is known that the coal is of the highest grade and of great thickness. Our photograph is taken along the Tanana River, and shows two veins, each forty feet in thickness, outcropping one above the other. In this region there is coal enough to make amply worth while the development of the district; but the Federal government's regulations, to put the case mildly, are not such as to encourage the undertaking; while the transportation costs to any point of large consumption are so problematical as to make it problematical when the deposits will be worked. But they are always there, constituting a material reserve of coal against acute emergency.

The Uva-Chrom Process of Color Photography

THE methods of color photography thus far employed have had the disadvantage of demanding a rather long time of exposure. They are usually known as "3-color process," and are based upon the fact that all colors can be produced by the mixing of 3 primary colors —red, yellow and blue. A writer in *Reclam's Universum* for May, 1921, describes a new process known as the Uva-chrom process, by means of which the time of exposure can be much shortened. Whereas in the 3-color process the times of exposure bear the relation 1:4:7, in this new process the ratio is 1:1:1. Hence the period of exposure may be shortened to 1 second or even in some cases to ¼ of a second, in which case of course a large diaphragm or shutter must be employed.

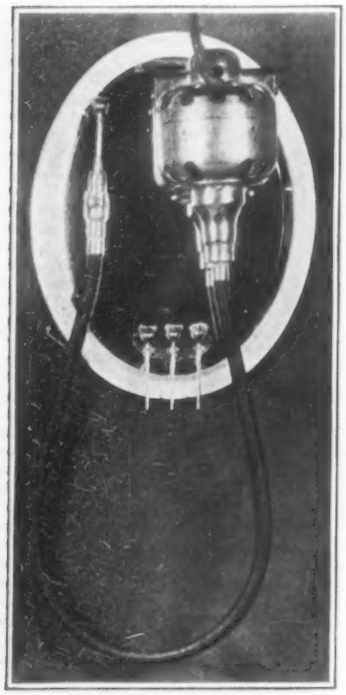
By the use of this new method a considerable advance is made toward the long-hoped for goal of taking photographs in natural colors, and experiments along this line are already very promising.

The Uva-chrom photographs are exceedingly clear cut and distinct and the colors are reproduced with admirable faithfulness; this is true of interiors, which ordinarily offer a good deal of difficulty. Since the pictures have no "grain," but are produced on the smooth plate, or rather on the emulsion which covers the latter, a comparatively feeble source of light is all that is needed—*e.g.*, a half-watt lamp connected with the wiring of the room.

For outdoor photography of every sort the reduction in time of exposure is a decided advantage. It is only under selected conditions that exposures of over a second can be made of most of the common objects about us, as every amateur photographer well knows.

Inventions New and Interesting

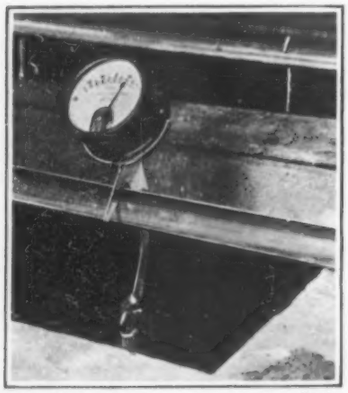
A Department Devoted to Pioneer Work in the Arts



The electric toothbrush

An Electrical Tooth-Brush

WE may still lack the electrical face-washer; the electrical collar-and-tie fastener, and the electrical explorer for restoring dropped collar buttons to us from their hiding places; but we are coming on nevertheless. Most of us may be supposed to have been to the dentist at one sad time or another, and to have had experience with the industrious little dingus with which he digs holes in our teeth. Certainly this electrical mode of attack is more effective than hand work would be. And if this is the case, why not employ it in the homely, every-day job of toothbrushing? The outfit that we illustrate echoes "Why not," indeed. The apparatus is six inches and a half wide by eight and a half long; it can be attached to any bathroom wall and driven from any lamp socket. And it will clean your teeth better than you ever cleaned them by hand.



It registers amperes per square foot of plating surface

A Meter for the Electroplater

LESS than ever need the electroplater, with the foot-ampere meter here illustrated at his disposal, depend upon guesswork. This meter consists of a small ammeter conveniently mounted with a special electrode which is submerged in the plating bath when the instrument is hung on the tank rod, and which causes the dial to register the amperes per square foot of current flowing to work or from anode.

It requires but a few seconds to take a reading, and the plater needs but to hang the instrument in different parts of the plating vat to measure the current density at any point. The satisfactory results are obvious.

Recent Patent Decisions

Inspection of Litigant's Records.—In a suit by the McLeod Tire Corporation against the B. F. Goodrich Co., and on a motion by the plaintiff to be allowed to inspect plans and drawings, etc., Judge Hand said:

"It has been the practice in this district to attempt to simplify the issues and limit the testimony necessary at the trial by allowing inspection and compelling answer to interrogatories in patent cases very liberally. We have stopped little short of requiring almost everything except the names of witnesses and such information as would enable the interrogator to bring forward untruthful testimony to meet the evidence of his adversary.

"The only objection to requiring inspection of working drawings or blueprints from the records of the defendant showing molds, cores, and other working parts which have been used in the commercial production of defendant's tires is because of the contention that these represent the details of a secret process of manufacture employed by the defendant. Even if these things are secret, they could be produced at the trial, so that I do not see how the privilege can be preserved absolutely. I therefore grant the inspection called for. *McLeod Tire Corp. v. B. F. Goodrich Co. U. S. D. C. of N. Y.*

Patentability of New Alloys.—Appeal from a District Court from a suit wherein the decree was for the complainant. Reversed.

The patent relates to alloys of iron and steel, and particularly to the latter, where nickel is employed as one of the alloying metals, and the object of the invention is to produce an extremely tough metal with great resistance to shock.

The Churchward patents for an alloy of steel are held void for want of patentable invention. The point of law deduced is that novelty, in the sense of the patent law, in the proportion of basic metals used in an alloy, involves not merely figuring out proportions differing from any known before, but new results from the new proportions, developing a new metal or an old metal with new characteristic of structure or performance. *Bethlehem Steel Co. v. Churchward Steel Co. U. S. C. C. A. of Pa.*

The Right of a Licensing Patentee Against an Infringer.—The defendant admittedly sold its products as Tweedle boot tops. But the defendant contends that since the Tweedle boot top is made and put upon the market by the Tweedle Footwear Corporation under an exclusive license, the plaintiff individually has no interest left therein which he is entitled to protect by a suit in his own proper person as patentee.

Finding is for plaintiff. In an action by a patentee to restrain infringement of plaintiff's patent, and also to restrain defendant from using plaintiff's name in and about the sale of articles infringing plaintiff's patent (that is, for unfair competition), the question whether, since the article patented by plaintiff was made and marketed by a corporation under an exclusive license, the plaintiff had sufficient interest left therein to sue to restrain unfair competition, would not be considered on proof of but one sale by defendant of an article not bearing plaintiff's name, although the sale was made in response to a call for plaintiff's article, where such sale was made for the sole purpose of making the case upon such question. *Tweedle v. Royal Co. U. S. D. C. of Mo.*

Invention in Process Patents.—This is an application for an injunction to restrain alleged infringement of a patent covering a process of separating the moisture from liquids. The defendant is engaged in the business of condensing and pulverizing milk. The application is resisted on the ground that the patent is invalid and that the defendant is not shown to infringe. In a general way the process consists in introducing the milk to a concentrating chamber wherein it may be heated, and wherein also a vacuum is maintained for condensing purposes. When the product has been condensed to a requisite degree, it is withdrawn through a pipe and introduced

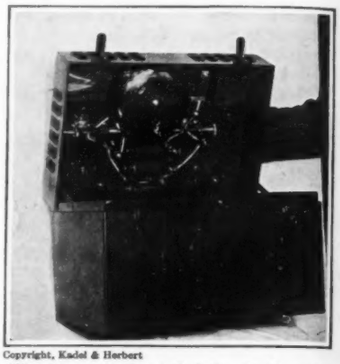
(*Continued on page 227*)

An Alarm to Foil the Hold-Up Man

HOLD-UP men who have been specializing in the robbery of bank messengers and payroll carriers will not rejoice in the invention of the latest security satchel, designed as it is to prevent their silent getaway. The satchel is ordinary enough in appearance, save that it is of steel. In the lid it carries a monster bell, operated by two dry cells which are capable of ringing the alarm continuously for six hours. The switch is hidden in the grip handle, and has two buttons, so arranged that when the messenger discovers that he is being held up he can instantly push one of them. The alarm will go off and stay off, and can be heard for a distance of half a mile. The second button is for previous adjustment, and leads to a delayed action that holds the ringing up for ten or twenty seconds—enough to enable the messenger to make *his* getaway from the immediate range of the hold-up man before the latter discovers what he is up against. We must agree with the inventor that no crook is likely to march through the streets carrying a ringing satchel, or to get very far with it if he attempts it. Certainly, until the stick-up artists learn how to put the muffler on the bell instantly and permanently, the new trick ought to be effective. And that is all that could be asked, for the man who is coping with a crook must expect to change his plan of campaign as fast as the crook learns what it is.

The Square Deal Gas Pump

SO far as a careful checking up of our gasoline mileage can tell us, we do not get cheated on gasoline in the Metropolitan district—in fact, if anything in the nature of error is made, the pump delivers a bit more gas than we pay for. But in less fortunate districts the swindle pump still holds sway, and anything designed to put it out of business is welcome to the motorist. Such a device is the one illustrated herewith, which pumps the gasoline from the underground storage chamber into a hollow glass container at the top of the stand. This glass is filled and emptied into the tank of the car a gallon at a time; in the language of the manufacturer, it delivers while measuring and fills while it delivers. It protects buyer and seller and operator against any controversy. It is of particular interest to the boss seller, because each of his employees has a key and can operate the pump only by the use of this key; and at the end of the day the pump yields a printed record, on cash-register tape and in cash-register style, of the day's business.



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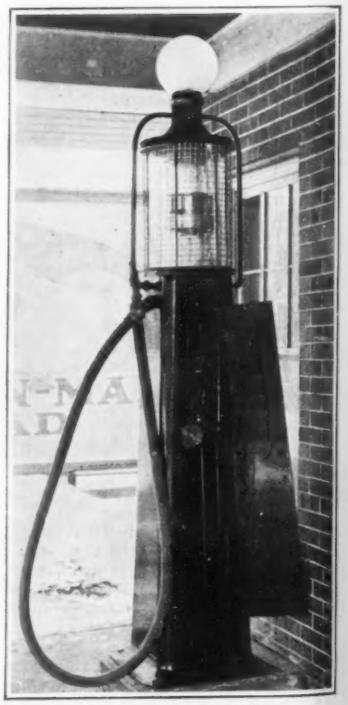
The alarm-bell satchel for bank messengers



The gasoline pump with visible measuring

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Saving Food Fish by the Hundred Million

(*Continued from page 216*)

normal health and well-being of the fish.

The fish training camps where the rescued members of the finny tribe are hardened for transportation to inland waters are located at La Crosse, Wis., and Bellevue, Iowa. At these places the fish are maintained in special tanks without food through which cool, clear water flows continually until they have recovered from their landwreck experiences sufficiently to be shipped to new homes. The Bureau of Fisheries now uses all steel distributing cars equipped with the most modern and efficient conveniences for fish transportation. These cars are always hauled on fast mail trains so that the fish will be in transit as short a time as possible. Sometimes a carload of fish is sent to one place while on other occasions the shipment consists of a mixed carload for several different places. Often farmers in wagons or automobile trucks meet the fish train and receive their quotas of the fish which they have requested for stocking private and public ponds and lakes.

The fish rescue work has never been able to develop on the economic scale which local conditions along the Ohio, Illinois, Missouri and Mississippi Rivers justify because Congress has never seen fit to make definite annual appropriations for the extension of this work. At present the rescue work expenses come out of the general fish propagation and improvement funds allotted to the Bureau of Fisheries. The annual rescue of landlocked fish is minute in proportion to the vast numbers which are lost due to the non-development of this efficient method of conserving our food and game fish resources. There are stretches of river bottoms in the Mississippi Valley over 500 miles in length which yearly suffer from uprisings and overflows where absolutely no fish rescue work is conducted despite that the losses of valuable foundation fish stock are excessive. A little rescue work is now being done along the Illinois River and these activities should be extended expeditiously to cover the Missouri and Ohio Rivers also. The states that border on the Mississippi should demand of their Government representatives that more extensive and detailed attention be devoted to the saving of food and game fish carried by floods from their normal places of abode to landlocked locations which sometimes are several miles inland from the river channels.

Recent Patent Decisions

(*Continued from page 226*)

into a desiccating chamber under pressure through a spraying device, and immediately carried through such chamber under the influence of air or gas as a desiccating agent, whereby evaporation takes place to such a degree that the particles of solids are precipitated and removed, after passing through a screen, from a collecting chamber.

The injunction is awarded; and the Merrill-Soule patent is held, in view of its general use, to disclose invention.

Where claims for a milk drying and pulverizing process were allowed by the patent office, the fact that other manufacturers, after the expiration of the patent covering the pulverizing process, deemed it necessary to use the condensation before pulverizing, shows that the claim of patentee that he produced an improved result, which was an invention, and not a mere aggregation of former processes, is well founded. That it would be possible to achieve the result obtained by the patentee by the use of old processes with greater care and skill than had been formerly used does not disprove invention, since the elimination of the necessity of great skill may itself show an improvement, evidencing invention. *Merrill-Soule Co. v. Rico Milk Products Co. U. S. D. C. of Wis.*

New Wine in Old Bottles. — The patents in this suit have to do with devices used in the sharpening, by grinding, of those cylindrical metal-cutting tools known as milling cutters. The essential elements of the machine are a grinding wheel and a spindle head, for holding the tool to be ground, so adjustable with relation to each other as to bring the grinding wheel to act upon the edge of the tooth at the desired angle. The machine is also equipped with an adjustable arm, bearing what is known as the tooth rest, upon the end of which the tooth is supported while ground.

It is contended by the defendants that there is no invention. It is also contended that the patent in question was anticipated by various devices and publications. It is held herein that the De Leeuw patent which is the one in controversy is valid and not anticipated, and also infringed.

The mere adoption of common expedients in adapting an existing machine to a new use is nevertheless invention, where the thought of the adaptation is new. *Cincinnati Milling Mch. Co. v. Oakley Tool Co. U. S. D. C. of O.*

Pearls in Plants

FEW people realize that there are such things as vegetable pearls. Yet, now and again, in certain tropical plants curious hard round substances are found which one may properly call pearls, seeing that their composition is almost identical with the product of the oyster. For instance, occasionally in Java these substances are discovered in the joints of bamboos. On analysis the bodies are found to consist of almost pure carbonate of lime—the same substance which goes to the make-up of the pearl of the oyster. Now and again similar bodies are found in the endosperm of the cocoanut while these plant pearls are known to occur in the wood of the pomegranate and teak trees. These vegetable pearls are sometimes as large as a hazel nut although as a rule they are somewhat smaller. Exactly how the vegetable pearls arise is not fully known. They are generally believed to be due to an excess of calcareous and silicious matter in the plant. The plant pedals are rarely seen apart from the East Indian islands for they are highly valued as charms. The owner will not part with one for any figure seeing that as long as he holds the pearl he considers that he will be immune from all ills which commonly assail mankind.

Fooling Fish With Colored Nets

DURING a journey of exploration to Dalmatia, Dr. Rudolf Ditmar of Graz observed that the Dalmatian fishermen used nets dyed in wonderful shades of brown and bright green. Searching inquiries on his part brought out the fact that the green nets were dyed by means of an extract made from the *Pistacia butiscus*, while the brown nets were colored by a dye obtained from the bark of the *Pinus malepensis*. The fishermen dye their nets by no means for the sake of mere picturesqueness. They have found by experience that while the fish are canny enough to fear the white nets and flee from them, as from a danger signal, they swim calmly into the meshes of the green and brown ones. It seems probable that this is because the green and brown strands of the nets are not unlike the floating strands of seaweed, though another explanation which has been suggested is that the eye of the fish is unable to distinguish these two colors from that of the sea water.

The dyes in question are extracted by means of fresh water from the bruised bark of the plants mentioned above. After the nets have been well soaked in these natural dyes and then thoroughly dried, the colors are found to be fast both as regards water and sunlight. These natural dyes are also used to color the sails of the boats and they possess the further advantage of containing oils and tannins which exert a preservative action.

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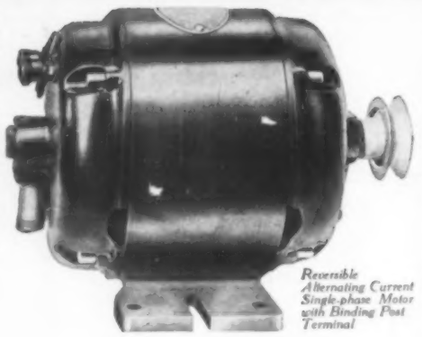

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